

CONTINUATION OF THE  
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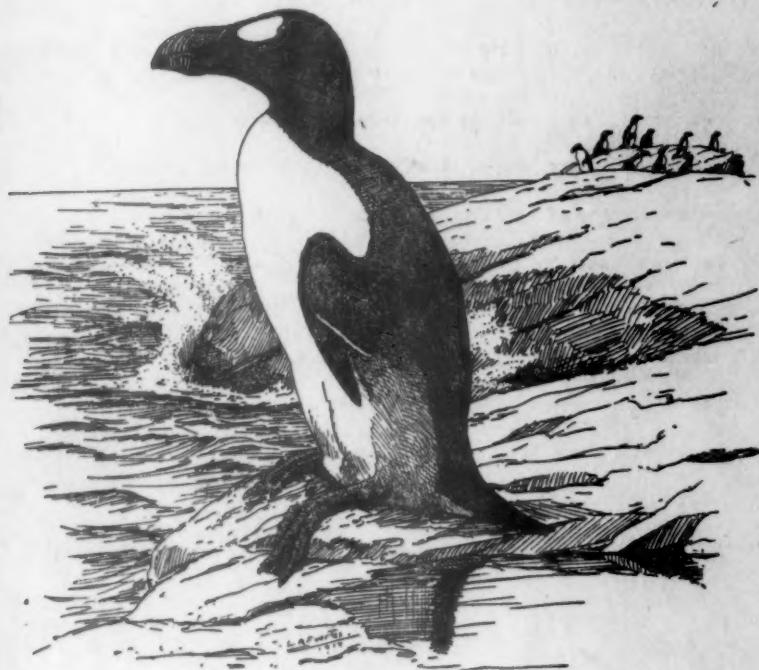
# The Auk

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WHILE this number of 'The Auk' was in press, its distinguished editor, Glover Morrill Allen, died suddenly of heart failure on the morning of February 14. Such was the orderliness of his way of work, that it was possible to bring out this issue without undue delay, in spite of the sudden and wholly unexpected catastrophe. For a catastrophe, and a great one, Allen's death is to the American Ornithologists' Union. The full measure of our loss is impossible to estimate, so many and so hidden were the springs of his intellect, and so tempered by experience and patient observation his scholarship and editorial judgment. He brought rich gifts to the editorship of this journal and applied them not only generously but with great discretion. Excellent though he was as an ornithologist, he was even more distinguished as a mammalogist, and in him were combined great learning and ripe wisdom in these two disciplines, to their mutual benefit. With his passing, the world loses one of its most scholarly naturalists and the Union a devoted and accomplished member.

In accordance with our custom, the president of the Union will appoint a biographer to prepare a memorial of our departed editor, friend, and counsellor for publication in an early number of 'The Auk.'

## BLUE AND LESSER SNOW GEESE ON SOUTHAMPTON AND BAFFIN ISLANDS

BY T. H. MANNING

### Plate 7

#### THE SOUTHAMPTON ISLAND COLONY

IN 1929, Sutton (1932: 44-57), while staying on Southampton Island, learned of a colony of Blue and Lesser Snow Geese (*Chen caerulescens* and *Chen hyperborea hyperborea*) at the Bay of God's Mercy. Owing to other work he was unable to visit it, but sent an Eskimo to make collections. In 1934, I camped near the center of this colony almost continuously from June 25 to August 7, and was, I believe, the first white man to visit it. The goose nests are situated almost entirely on grassy islands in the mouth of Boas River, where they are comparatively safe from foxes. At its mouth, the river is at least two miles wide, and in July is so shallow that it can be crossed in knee boots; but during the spring, it is greatly swollen. On both banks the river is bounded by about eight miles of flat marshland which terminates in disintegrated limestone ridges. In 1934, the concentrated breeding area covered about three square miles, with about fifteen birds to 10,000 square yards. For about another ten square miles outside this area, the average was about five birds to every 10,000 square yards. To every forty pairs of Snow Geese there were one pair of Blue Geese and two or three mixed pairs.

When I arrived at the colony on June 25, 1934, the ice and snow had all disappeared, and most of the geese had begun to incubate. Eskimos who had visited the colony on June 19 reported that most of the nests contained one, two, or three eggs, and that the river was very swollen, with ice still on the bottom. They also said that a little earlier, large flocks of Blue and Snow Geese had flown over their camp which was situated some twenty-five miles to the east, thus bearing out the suggestion made by Sutton (1932: 53) that they migrate over Coates Island, or at least toward the east coast of Hudson Bay. In this connection it may be remarked that when I was at Daly Bay and Cape Fullerton about mid-June 1936, no Snow or Blue Geese were seen.

In the many hundreds of nests seen, the average number of eggs for a Snow Goose was five or six, while seven was not uncommon. Three nests had eight, and two held nine eggs. It is possible that these large clutches were due to two birds having laid in the same nest;

but I have no evidence to that effect and normally a goose approaching a strange nest will be driven off. The Blue Goose and hybrid nests had rather fewer, at most, five eggs; but as comparatively few of these were observed, I could not assert this as a general rule.

During the incubation period, the female rarely if ever leaves the nest except when disturbed, and much of the time the male stands by her side. If the male has been killed, or possibly if he has deserted, the female will most frequently continue incubation. I have no evidence that the male ever incubates. All the birds that I collected after having seen them leave the nest were females, and I have never collected a male with the least indication of an incubating patch. These two remarks apply equally to Brant, Lesser Canada, and Hutchins's Geese. About a hundred and fifty yards from my tent at Boas River was a hybrid nest which was observed about fifteen times a day. The female, a Snow Goose, was invariably on the nest, while its Blue Goose mate, a particularly faithful bird, stood by. The same applies to a hybridizing pair on Baffin Island; each of the three times I visited their nest, the female was incubating.

Many Herring Gulls nest in the colony, chiefly on large glacial boulders. Whenever my passing disturbed a goose and caused it to leave its nest, a gull would soon swoop down to examine it, and, on seeing the eggs, alighted close by. That, however, was usually as far as it got before the parent goose, most frequently the female which always kept a close watch about a hundred yards away, returned, quite oblivious of my presence, and, alighting some yards from the nest, with flapping wings made a dash at the intruder. In its hurry it would often fall flat on its breast. If geese have time, they cover their nests with down before leaving them, and unless the gulls actually see the eggs, they rarely trouble to investigate further. That the gulls do account for large numbers of eggs was shown by the pecked ones scattered about the colony, but I am inclined to think that most had been previously abandoned by the parents.

It was not rare to see a Herring Gull's and a goose's nest within a few yards of each other. In this case there appeared to be a truce between the two parties; the gulls never attempted to take the goose eggs, and the geese did not try to drive away the gulls. There was an example of this near my tent: both nests were on a small island five yards long, past which I often walked to observe the birds' behavior on being disturbed. On every occasion each would return peaceably to its own nest.

Until about four days before hatching time, geese of both sexes

were wary unless their eggs were threatened by a gull or jaeger, and it was not until after the young were hatched that the male became really tame. Then I was able to walk to within ten or fifteen yards of a nest without the parent leaving. When they were moving away from the nesting ground, although few if any of the parents had lost their primaries, it was almost impossible to flush them.

With very few exceptions, the eggs hatched between July 14 and 17. Immediately the young are sufficiently strong, that is, in about three to four hours after the last has hatched, the parent leaves the nest and calls to them to follow. They will follow either parent, but it is usually the female that calls them on, while if danger threatens, the male remains behind hissing defiance. As soon as they can walk, they can swim and dive. I saw numerous nests containing a single pipped egg, or even a live chick as yet too young to follow; these had been deserted by the parents who seem to be in the greatest haste to move off and collect into flocks. Of those families observed before they joined a flock, not one had more than five young. As I walked through the colony at hatching time, I saw many young that had lost their parents. Occasionally these managed to catch up with another family, and after an examination by the mother, were adopted. If I picked up one of these lost birds or stopped to examine it, it would thereafter follow me as readily as its parent. Probably the gulls soon dispose of strays as well as deserted eggs and young. Near the edge of the breeding ground there were several flocks apparently waiting until sufficient families had collected together. When a flock contained about forty old birds, it moved off. When they had formed into flocks, the family groups seemed to lose their identity.

By July 19, all the geese had left the nesting ground. The Eskimos say that they go to some big lakes about fifteen miles inland. When the Eskimos visited the nesting ground at the beginning of August 1933, they found no geese. In 1934, although the geese never returned to the nesting ground, small flocks were usually in sight from my camp. The first time I had an opportunity to go after one of these was on July 25. There were thirty adults in this particular flock and twice as many young. Five adults were shot; of these, only one retained some of its flight feathers. A few flew when I shot. By August 2, the young were sufficiently grown for ringing, and a flock of two hundred adults with an equal number of young was rounded up for this purpose. Only one could be induced to fly, and so far as I could tell, the remainder were without flight feathers.

Returns for 72 downy Lesser Snow Geese banded between August



TEXT. FIG. 1.—Dotted areas where Blue and Snow Geese nest at least occasionally. In the area marked (?), Blue and Snow Geese are said to be numerous, but whether they actually nest there is unknown.

Lined areas where there is considerable low-lying marsh land which would appear fairly suitable for nesting, but where, so far as the writer knows, no nests have been found.

2 and August 12, 1934, at the Blue and Snow Goose colony at the Boas River, Southampton Island, are as follows:—

<i>Recovered at</i>	<i>Date killed</i>
Near Assumption Parish (presumably), Napoleonville, Louisiana	November 2, 1934
Near Collegeport, Texas	November 3, 1934
Port Arthur, Texas	November 4, 1934
Five miles from Palacios, Texas	November 4, 1934
Near Port Arthur, Texas	November 7, 1934
Twenty-eight miles southwest of Bay City, Texas	November 9, 1934
Chambers County, Texas	November 10, 1934
Near Port Arthur, Texas	November 10, 1934
Matagorda Bay, Collegeport, Texas	November 18, 1934
Fourteen miles southwest of Corpus Christi, Texas	November 24, 1934
Sixteen miles west of Corpus Christi, Texas	November 25, 1934
Near Corpus Christi, Texas	November 25, 1934
Fifteen miles south of Corpus Christi, Texas	November 30, 1934
Ten miles southwest of Port Arthur, Texas	December 7, 1934
Fifteen miles east of Palacios, Texas	December 15, 1934
Trout River, south coast of Hudson Bay, 70 miles northwest of Cape Henrietta Maria, Ontario	May 27, 1935
Bala (presumably), Kansas	November 4, 1935
Johnson's Bayou, Louisiana	November 28, 1935
Moosonee, Ontario	May 1936
Between Kaskalamagan and Severn Post	October 15, 1937
Bay City, Texas	December 20, 1937
Delaraine, Manitoba	January 22, 1939

Of three Blue Geese banded at the same time, one was shot by an Indian near York Factory, Manitoba, some time previous to 1940.

Acknowledgments for the above returns are due to the United States Bureau of Biological Survey, and to the Lands, Parks, and Forests Branch of the Department of Mines and Resources of Canada; also to those who kindly returned the bands to the Biological Survey.

I identified no yearling geese at the colony. There were usually several flocks of presumably non-breeding birds feeding along the shore at the edge of the colony. They were difficult to approach closely, but I think they were mature birds, possibly some that had lost their eggs. The yearling birds are probably scattered on suitable feeding grounds throughout the island, and I have observed small flocks at several places. Nearly all the geese seen actually in the colony had nests. A greater relative proportion of those seen without were Blue Geese.

When the geese arrive at the breeding grounds, they are still quite fat, but once laying starts, their condition rapidly deteriorates. When driven from their nests, they always take the opportunity to feed,

but I think the female seldom or never leaves the nest for this specific purpose, although she pecks at any moss that is within reach. By the time the young hatch, there is no vestige of fat on either sex; their breast muscles are also much reduced, and their gizzards are small. During the flightless period, the breast muscles are further reduced, the gizzard rapidly becomes more than twice its former size, and the legs grow large and muscular.

In 1936, Bray (1936-37) spent the summer near the colony and I visited it on two occasions. On June 21, there were only a few places completely bare of snow, and Boas River was as yet indistinguishable from the remainder of the flat land, all of which was intersected with streams and pools of water under the snow. I found one nest with two eggs, and two nests with one egg each. The next time I was able to visit the colony was on July 1, and incubation had begun. There were considerably fewer birds nesting than in 1934. This was also borne out by Bray's estimate of the number. It seems likely that the decrease was due to the exceptionally late thaw which either prevented the birds from finding suitable nesting sites, or destroyed their nests by flooding, in which case they would probably not remain in the colony. I had observed a few nests destroyed by flooding in 1934.

Birds seen in the goose colony while the geese were nesting, were in the order of their abundance:-

- Snow Goose—common and nesting.
- Herring Gull—common and nesting.
- Sabine's Gull—common and nesting.
- Arctic Tern—common and nesting.
- Blue Goose—common and nesting.
- King Eider—some nests found.
- White-rumped Sandpiper—two nests found.
- Red-throated Loon—some nests found; possibly an occasional Black-throated Loon.
- Red-backed Sandpiper—no nests found.
- Red Phalarope—no nests found.
- Ruddy Turnstone—no nests found.
- Knot—no nests found.
- Hutchins's Goose—two nests found. Often seen flying.
- American Brant—two nests found. Often seen flying.
- Parasitic Jaeger—occasionally seen flying and stealing eggs; common until June 28.
- Semipalmated Sandpiper.
- Lapland Longspur.

#### BAFFIN ISLAND BREEDING GROUND

This is not a single colony, but several, separated by areas in which are scattered nests. The greatest concentration of Blue Geese is on

the east side of Bowman Bay. This colony was found and studied by Soper (1930) in 1929. Although he found a considerable number of nests, it appears that they were not nearly as close together as those of the Snow Geese at Boas River on Southampton Island. An Eskimo who travelled along the coast in November 1938, said he saw numerous old nests in two places between Bowman Bay and the Koukduak River. In 1910, Hantzsch (Hesse, 1915: 156-166) found many geese on the western side of Lake Nettilling, particularly near the Koukduak River. These were mostly Snow Geese; but on July 31 he (Hesse, 1915: 158) notes: "Only a few dark specimens yet." Since it was too early for these to be young, they were presumably Blue Geese. From August 30 to September 3, 1925, Soper (1928: 91-93) saw numerous flocks of Snow Geese near where the Koukduak River leaves Lake Nettilling. It was then too late to tell if they had nested there, but a corral on one of the islands in the river showed that flightless geese had once been numerous there (cf. Hesse, 1915: 157).

Between August 19 and 24, 1938, I went by boat up the west coast of Baffin Island. From the south side of Bowman Bay to the north shore of Taverner Bay, the land is absolutely flat. In whichever direction one looks, the long, waving grass of the marshes is bounded by the flat circle of the horizon. In places the tide goes out about ten miles, leaving mud and gravel flats. It is a country suitable only for the breeding grounds of geese, ducks and shorebirds. Every time we approached the coast sufficiently closely, we saw mixed flocks of Blue and Snow Geese, both flying and flightless; those flying were probably immature. If immature geese are ever completely flightless, it is probably at an earlier date than the mature birds.

I walked inland in only one place, about fifty miles south of the Koukduak River; that was on August 21. There were several flocks there, but I approached only one closely. It consisted of about three hundred Snow, and fifty Blue Geese, with a nearly equal number of young. About a third of the adults could fly well, half a little, and a few not at all. The development of the young varied from those having feathers just showing, to some that were completely feathered and had only a small amount of down left on the neck. Most were in the latter stage. This variability was rather surprising and contrary to my observation on Southampton Island in 1934.

The spring of 1939 was spent at the north end of Taverner Bay. Having seen several flocks of Blue and Snow Geese there the preceding fall, I was disappointed to find only one nest in the neighborhood. It was by a small lake on a rocky ridge, a very unusual place. On August 5, at the mouth of the Koukduak River, I observed closely



(TWO UPPER) FEMALE BLUE GOOSE AND YOUNG  
(LOWER) LESSER SNOW GOOSE AT NEST



a flock of about two hundred adults with one hundred and fifty young. All were flightless. There was an age variation in the young of at least a week. Several other flocks were seen both there and between the mouth of the river and Taverner Bay. All the flocks were mixed with at least ten per cent Blue Geese.

Back at Taverner Bay on August 25, flocks of Blue and Snow Geese which had been fairly numerous during the spring but almost absent during the breeding season, again became plentiful. Young birds first began to appear in these flocks during the first few days of September, and rapidly became more numerous. From these facts it might be thought that they were migrants from the north, but during the previous year at Hantzsch River, some twenty miles north, we had observed no geese flying over. I therefore concluded that these flocks were merely taking advantage of all the available feeding ground in the vicinity, although from my next year's (1940) observations it appears that they were at least fifty miles north of their breeding grounds at a time when they might be expected to be moving southward. Another indication that they were not from the north is that in August 1940, I went around the north coast of Foxe Basin, for the most part closely following the coast, without seeing a sign of geese. On the north Baffin coast, the geese of the genus *Chen* are usually supposed to be the Greater Snow Geese, and none of these was identified at Taverner Bay. Bray (1936-37), however, mentions two specimens from Strathcona Sound, Admiralty Inlet, which he thought were *C. h. hyperborea*; these may migrate up the west side of Foxe Basin. Bray (1936-37) says that according to the Iglulik Eskimos, there is a Snow Goose colony (subspecies unknown) on Baird Peninsula and Bray Island, although they judged from the old stone corrals, at one time used for capturing flightless geese, that they are less plentiful there than formerly. Since it is possible that the Eskimos had not visited either of these places in summer for many years previous to giving this information, these colonies may no longer exist. I did not, however, visit the south and west side of Bray Island or the north side of Baird Peninsula. There is a faint possibility that some Blue or Snow Geese nest on lakes about twenty miles up Hantzsch River, but the type of country is not that usually selected by these species. In 1939 the last geese were seen at Taverner Bay on September 10.

At the beginning of June 1940, we established our camp about ten miles south of Taverner Bay, and from there the coast between the Kukdjuaq and our last year's (1939) camp was searched for a Snow and Blue Goose colony. However, I succeeded in finding only four

Snow Geese, two Blue, and one hybrid nest. I also made one big circle inland from the Koukdjuak to the eastern end of the flat land and back to Taverner Bay. It seems unlikely that I should have missed a sizeable colony on the coast, and inland I saw considerably fewer geese. Those I did see were all flocks of yearlings. The brooks soon 'peter out' inland, and the large lakes were still frozen at the end of June, so that geese could obtain little or no protection on islands in them. Soper (1930: 25), mentions a large number of geese migrating over the upper part of the Koukdjuak River in late August and early September 1925. As there were no Blue Geese among them, he concluded that this species did not breed north of the Koukdjuak River. It now seems probable that neither Blue nor Snow Geese breed in great numbers on the flat land north of the river, although many flocks feed there. Since all the larger flocks seen at Taverner Bay contained a considerable proportion of Blue Geese, the geese mentioned by Soper may have been migrants from much further north; possibly they were the Greater Snow Geese (*Chen hyperborea atlantica*).

In 1940, the first Snow Geese were seen at Taverner Bay on June 2, the first Blue Geese on June 8. In 1939, neither was seen until June 8. A record was kept of the approximate number of birds seen each day. The totals of these for June and the first nineteen days of July in 1940 are 820 Snow, and 381 Blue Geese. This large proportion of Blue Geese was not observed in the flightless flocks either at Koukdjuak in 1939 or fifty miles south of there in 1938. Except in the early part of June, most of the geese seen were yearling non-breeding birds, and it is probable that a large number of the Blue Geese originated from Bowman Bay, where Soper (1930: 55) states they outnumbered the Snow twenty-two to one. The proportion of Blue to Snow Geese that breed north of Bowman Bay is between ten and twenty-five per cent.

I have mentioned that the Eskimo visited the Southampton Island goose colony in 1934. It is probable that they visit this colony about once in two years for the purpose of collecting eggs. When they do, they take perhaps 1,500 eggs and shoot 100 birds. This is a small number compared to the number of birds in the colony, and no one familiar with the conditions among the Eskimos could possibly begrudge them these, particularly when one considers the number which my band-recoveries indicate are killed by sportsmen in the South. Stone corrals and caches filled with bones show that previously the Eskimos killed a very large number of geese while they were flightless. Now they rarely if ever visit the colony at that time.

The number of geese, and especially Blue Geese, on the west coast of Baffin Island far exceeds that on Southampton Island. The area covered by them is so large, and I saw so little of it in detail, that I have considerable hesitation in suggesting even the approximate number. Certainly there must be over 100,000 Snow, and nearly or quite as many Blue Geese. I know of no occasion in recent years when the Eskimos have visited this area during the nesting season. The extreme flatness of the land and the shallowness of the water make the district very uninviting to them. During the time I was there, the nearest Eskimos were over 150 miles by sea from the extreme south of the area, and nearly 300 miles from the north.

INCUBATING PERIODS AND HATCHING TIMES  
1940

*Blue Goose Nest containing Five Eggs*

*June 17:* Found Blue Goose nest with two eggs.

*July 12:* At 11 hrs., one egg just pipped.

*July 13:* At 06 hrs., two hatched, two pipped. At 11 hrs., four hatched and could just get out of the nest while the other egg was well pipped. As they normally lay an egg a day and probably begin incubation very soon after the full clutch has been laid, this gives an incubation period of twenty-three days.

*Snow Goose Nest containing Four Eggs*

*June 18:* Found a Snow Goose nest with three eggs.

*July 11:* 00 hrs., three eggs well pipped; 08 hrs., two hatched and fluffy, one half-hatched, and one well pipped.

12 hrs., three hatched, two just able to leave nest, the last almost out of the shell. This gives an incubation period of twenty-two days. The difference in period can be explained as being partly due to my knowing only within twenty-four hours the time that the last egg was laid, and partly due to individual variation. With regard to the latter, whereas it was noted that the Snow Goose was a very close sitter, hard to flush, returning to its nest immediately after I left, the Blue Goose was emphatically the reverse. From the time I found the eggs till July 10 I did not visit either nest.

*Hybrid Nest containing Four Eggs*

The nest of the mixed pair was not found till incubation had begun. As it was too far away from the other to be closely observed, the eggs were removed and placed in a nearby Blue Goose

nest, after first removing the four eggs in that nest. All these latter were found to contain undoubted Blue Goose embryos.

*July 10:* At 17 hrs., eggs removed from the hybrid nest. At 21 hrs., while being carried in my shirt for warmth, the young in two eggs began to chirp. At 24 hrs., eggs were placed in Blue Goose's nest.

*July 11:* At 23 hrs., two eggs well pipped.

*July 12:* At 11 hrs., two hatched and one pipped.

*July 12:* At 16 hrs., two able to follow parents, one just hatched; the fourth egg, very rotten, contained little except dirty liquid, and was presumably a last-year's egg.

An incubation period averaging twenty-two days agrees with my approximate observations on Southampton Island. The hatching of only three sets of eggs was actually observed at Taverner Bay, but the approximate start of incubation of five others was noted, including one in 1939. The incubation of these began about June 19, and they might therefore be expected to have hatched on July 11. Although over two hundred miles farther south the average hatching date at the Southampton Island colony was July 15, in 1934, and according to Bray (1936-37), July 17 in 1936. At Bowman Bay, in 1929, Soper (1930: 58) collected a series of young that he considered not more than two or three days old on July 20 and 21.

#### SPECIFIC STATUS OF THE BLUE AND SNOW GEESE

It is generally considered that the Blue and Snow Geese are separate species. From his observations of the Blue Goose colony at Bowman Bay, Soper (1930: 14-15) was led to this conclusion; Sutton (1931: 362) also held the same opinion. My observations on Southampton and Baffin Islands, however, do not entirely agree with this.

Except for the color of the plumage, the Snow and the Blue Geese appear identical. In body form, stance, behavior and calls, I have been unable to detect any difference. Their nests and eggs are indistinguishable. The only contradiction of this is given by Hon. R. M. Barnes from observations on captive geese. Bent (1925: 181) quotes him as saying: "In addition to the difference in the young and eggs, the build of the two birds is very different, and their physical appearance is very distinct. The call notes are not very similar." Soper (1930: 53), who made extensive collections and measurements of eggs, was unable to find any difference between those of the two species. As I have already mentioned, there seems to be a difference in the size of the clutch laid at the Southampton Island colony. There, the average for the Snow Geese was five or six; for the Blue,

only four. The same was noted by the Eskimos reporting to Sutton (1932: 55). On Baffin Island, however, there is no evidence to support this. The nests I observed at Taverner Bay gave a slightly larger average for the Blue Goose than the Snow, but insufficient nests were seen for generalization. The average given by Soper (1930: 53) for eleven [full?] sets of Blue Goose eggs is three eggs to the set; he also notes that several nests of Lesser Snow Geese contained from one to five eggs. It might be thought that the large proportion of Blue Geese that on Southampton Island must be hybrids has reduced their fertility, but this can hardly be reconciled with the fact that both species appear to have larger clutches there than on Baffin Island. Further exact observations of a large number of geese known definitely to be incubating are therefore necessary. There is no reason to suspect that the light-breasted Blue Geese are less fertile than the others. Since evidence to the contrary is lacking, it may be assumed that the large percentage of Blue Geese that hybridize on Southampton Island indicates the fertility of the cross; otherwise the Blue Geese would be bred out unless constantly augmented by Baffin Island birds.

The main breeding ground of the Blue Geese is in the Bowman Bay region. There Soper (1930: 55) estimates that they outnumber the Snow Geese by about twenty-two to one; on Southampton Island and to the north of Bowman Bay, the Snow Geese are in the majority; and to the west on the Canadian mainland, there may be colonies of Lesser Snow where no Blue Geese occur at all. This, however, is not a satisfactory argument against dichromatism, as the same phenomenon also occurs among other dichromatic species: witness the variation in the relative abundance of the white and blue Arctic foxes (*Alopex lagopus*) from one per cent blue on the west coast of Hudson Bay to over fifty per cent in Greenland. Also Johnson (1938: 56-59) shows that there is an almost equal variation in the percentage of 'white-eyed' individuals occurring in the colonies of the Common Murre (*Uria aalge aalge*). Although on a wide geographic basis the two species of geese are partially segregated, at the Southampton colony the Blue Geese were scattered uniformly throughout, and did not show any tendency to form into separate flocks. At Taverner Bay in the spring of 1940, flocks of geese were quite often seen which contained considerably more Blue Geese than the average for that district, but these were mostly non-breeding yearling birds, and probably belonged to the Bowman Bay colony. Among the flightless flocks seen with young near the Koukduak River, there was no segregation. Soper (1930: 14) states that "during

migration, even though evidently never wholly absent from each other, the Blue and the Snow Geese appear to split at, or south of James Bay, into two main bodies to follow separate courses, as would distinct species with independent and hereditary migrational routes, the Snow Goose to follow the west coast of James Bay, and the Blue the east side." I suggest that rather than the Blue separating from the Snow, it may be the severance of the Bowman Bay group from the remainder, irrespective of whether they are Blue Geese or Snow. Lewis and Peters (1941: 112) were informed that although twenty years ago the proportion of Blue Geese on the west coast of James Bay was small, it has gradually increased until the Blue Geese are about as numerous as the Snow.

The young of the Blue Geese, although similarly marked, are much darker all over than those of the Snow. This dissimilarity Soper (1930: 15) considers an indication of their specific difference. It is true that in some groups of birds, for instance the plovers, the young of different species resemble each other much more closely than do the adults; but the adult Blue Goose is so much darker than the adult Snow that the melanistic character of the young is not surprising. The downy young of not only different breeds of Domestic Fowl, but also of different colors within the same breed (Warren, 1929) show a considerable variation in color, yet no one would suggest that they were different species. There are two color phases of downy Arctic Terns (*Sterna paradisaea*) although the adults are identical (Bent, 1921: 253). When the geese are between two and three weeks old, their dissimilarity is not nearly so well marked (this was noted particularly on Southampton Island). Not only the down, but also the feet and the bill of the Blue Geese become distinctly lighter. Possibly this is due to fading.

That Soper (1930: 15) found no geese hybridizing at Bowman Bay is surprising, but as he does not mention the total number of Blue and Snow Goose nests observed, it is difficult to say whether this may not have been accidental. That the same species of birds which hybridize on Southampton should not do so on Baffin Island under the same conditions is unlikely; and indeed, the finding of one mixed nest among the three Blue and four Snow Geese on the north of the Koukdjuak, shows that they do hybridize there at times. Whether they are less inclined to hybridize when the Blue Geese are in the majority, as at Bowman Bay, is an interesting point needing further investigation.

The hybrid pair collected on Baffin Island had two apparently Blue and one apparently Snow offspring. Only the female parent,

a Snow Goose, was collected, but the breast of the male was seen to be quite dark. As there were no other nests within at least five miles, confusion was impossible. One set of hybrids collected on Southampton Island consisted of one Blue Goose and three Snow Geese, the other of one Blue Goose and two Snow Geese. These were taken in the nest. None of the parents of the Southampton hybrids was collected but they were identified as being pairs with certainty. Obviously, from a distance of twenty-five yards there can be no question of confusion between a Blue and a Snow Goose. Bray (1936-37) says that of fourteen hybrid young (three broods) that he collected, six were indistinguishable from pure Snow Geese, five were indistinguishable from pure Blue Geese, and one differed from the latter only in the possession of a tiny yellow patch on the side of the throat. Besides those collected, there were probably many hybrids among the hundreds of young seen on Southampton and Baffin Islands, but in no case could they be distinguished from the birds of pure stock. Blaauw (1907: 623), who conducted breeding experiments with captive Blue and Snow Geese, found the same lack of hybrid character in the downy young; whence he concluded that they were two color phases of the same species. Details of his experiments are unfortunately not given.

In the adults as well as in the young, there are no birds that are obviously hybrid: that is to say, there are none whose color approximates to half-way between a Blue and a Snow Goose (cf. Sutton, 1931: 360). It is usually assumed, probably correctly though without evidence, that the light-breasted variety of Blue Goose is a hybrid between the Snow and the Blue Goose. To the best of my remembrance, the majority of the Blue Geese at the Southampton Island colony have considerably lighter breasts than those of the Baffin Island group; this seems to indicate that the assumption is correct. When it is possible to make a comparison of all the Blue Geese now collected from their breeding grounds, this point may be elucidated.

About five per cent of the geese breeding at the Southampton Island colony were Blue Geese; of these a little less than half (750), or about 650, were mated with Snow Geese. If they had picked their mates according to the law of chance, there would have been 1,420 mixed pairs, and only 40 Blue pairs. It is therefore evident that most Blue Geese prefer a Blue mate. This may be evidence of a more deeply seated difference than mere color variation, but I would not be surprised if captive Snow Geese showed a similar inclination to mate with artificially colored birds, although naturally,

those artificially colored would not discriminate against uncolored birds. Johnson (1938) considered that the mating of 'White-eyed' Murres with normal individuals was purely random, but the color difference in that case is not comparable to that between the Snow and the Blue Geese.

Sutton (1931: 360), although considering it improbable, refers to the possibility of some of the hybridizing Snow Geese being albinistic. There is, however, no difference between the Snow Geese mated with Blue Geese and those mated with other Snow Geese. The color of the feet, bill and eyes in adult Snow Geese is the same as that in adult Blue Geese. Sutton (1931: 363) also suggests that cross-mating may be due to an excess of one sex over the other. Bray (1936-37) verified that in four out of the six hybrid pairs he recorded, the male was a Blue Goose. Unfortunately I made no notes on this question in 1934, and I cannot therefore say whether it is more than coincidence that in the only six hybrid pairs on which there is definite information, the male was a Blue Goose. It is probable that had this been an invariable rule, it would have attracted my attention in 1934. An excess of male over female Blue Geese on Southampton Island may be the effect rather than the cause of a greater tendency for that sex to hybridize.

It was unfortunate that neither Bray nor I was able to collect or observe any 'pure' Blue Goose families on Southampton Island before they became confused in flocks, as, owing to the presumed hybrid derivation of most of the Blue Geese at the colony, one would certainly expect a mixed brood of chicks unless the blue characteristic acted as a recessive. I saw one or two broods of Snow Geese that had at least one Blue young with them; but as they had left the nest, they may easily have become mixed.

Soper (1930: 15) states: "All birds observed were pure and characteristic of the invariably similar parents which they followed." This is to be expected if for some reason the Bowman Bay birds do not hybridize, and if Soper saw sufficient broods of both species, it may be taken as further evidence that they do not hybridize there, but it is doubtful from his paper whether he saw many young Snow Geese. It is not, as Soper says, an argument against the Blue being a color phase of the Snow Goose, since it assumes that in cases of dichromatism an animal of one phase will arise from a pair of animals of the other phase, even though these latter are homozygotes. This is a thing which, so far as I know, has not been proved to occur in any case of dichromatism, and all evidence supports the opposite conclusion. For instance, both blue and silver foxes breed true in

captivity although they are usually regarded as color phases of the white and the red respectively. In the case of the Blue and the Snow Geese, it is obvious that the two have a common ancestry. As the interbreeding of the two species does not produce an intermediate form, it seems likely that their common ancestor was either of pure Blue or of pure Snow Goose stock. For the sake of argument, I shall assume it to have been a pure Snow. This is the more probable as it is the more widely distributed species. The lack of intermediate forms (if we except the rather doubtful white-breasted Blue Goose) suggests the formation of the Blue species as a sudden mutation from the Snow. Whether a mutation forming a single individual would be sufficient, or whether several were formed at the same time or at different times, I do not know. But that these mutations must necessarily be continuing at the present time in order for it to be recognized as a case of dichromatism, would necessitate a definition of dichromatism that would prevent the term being applied to the majority, if not all the cases, for which it is now used. If the mutations occurred at only one place, and at a date comparatively recent, it may account for the continued concentration of Blue Geese on the breeding ground at Bowman Bay, and perhaps also their apparently recent spread.

#### CONCLUSIONS

##### Reasons for considering the Snow and Blue Geese as

###### *Separate species*

Marked color difference.  
They do not hybridize indiscriminately.  
Apparent difference in the number of eggs to the clutch on Southampton.  
Other reasons mentioned above but not considered valid by present writer.

###### *Same species*

Apparently identical in body form.  
Behavior identical.  
Calls similar (or identical).  
Flock, feed, breed, and nest together.  
Eggs and nests identical.  
Hybridize freely.  
Hybrids may be presumed fertile.  
Similar length of incubating period.

Although I have attempted to show that some of the reasons previously given against considering the Snow and the Blue Geese as two color forms of the same species are not justifiable, and while perhaps there is as good a reason for considering them a dichromatic species as there is in some other forms of birds and mammals which are now so-called, the fact that the Snow and Blue Geese nesting in the colony do not hybridize in the proportion that would be expected if the birds were identical, is perhaps sufficient reason for not considering them dichromatic phases. Other birds and mammals

which are classified as dichromatic forms may also show a disinclination to breed with the opposite phase, but obvious difficulties of making observations on non-colonial forms may have concealed it. Also, as I have pointed out, the Snow and Blue Geese have a better opportunity to select a desirable mate than solitary species, and are probably more careful than the polygamous species.

A large number of separate species and even genera will on occasion hybridize, and some will produce fertile offspring; but when they hybridize regularly as the Snow and Blue Geese do on Southampton Island, it seems extremely doubtful whether they should be considered as separate species, especially when the only proved difference in the two forms is one of color. I therefore believe that the relationship between the two forms can best be expressed by considering them subspecies. However, it seems hardly desirable to make any change in their present status until further work has been done both on their breeding grounds and in captivity. This should include not only the Blue and the Lesser Snow Geese, but also the Greater Snow Goose.

#### EXPLANATION OF PLATE 7

*Top figure:* Female Blue Goose with newly hatched young in nest. Taverner Bay, west coast of Baffin Island.

*Middle figure:* The same nest a few minutes later when the young attempted to follow their mother. Probably they would not have left the nest for a few hours had they not been disturbed. Note the pipped egg.

*Bottom figure:* Lesser Snow Goose at her nest. Taverner Bay.

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## EASTERN POPULATION OF THE DUCK HAWK

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## INTRODUCTION

THE breeding sites of the Duck Hawk (*Falco peregrinus anatum*) are marked by such a well-recognized permanency that the species offers some interesting possibilities for the study of bird populations. When, in 1937, a census of these cliffs was undertaken for the Hawk and Owl Society, it was felt that so many nests, observed by so many different people, lent themselves admirably to a national inquiry. One could learn if the falcons were decreasing in numbers, perhaps determine that population curves were evident, and so on. By a happy coincidence, Dr. R. M. Bond had already started a similar survey on the Pacific coast, and he subsequently agreed to enlarge his investigation to cover the region west of the Rockies. As his results will be published separately, the present paper covers North America exclusive of Alaska, British Columbia, Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, and western Mexico. Both these papers rely primarily upon the extensive method of investigation—a technique which of necessity yields uneven results. They will, however, be richly complemented by J. A. Hagar's study (in preparation) which is based entirely on the intensive method—six years' observations of a daily character on all the eyries in Massachusetts.

It was hoped at first that questionnaires would yield the data needed. These have proven of great value in the British Isles, but the United States—polled by Gallup investigators, by Crosley telephone girls, and by 'Fortune' surveyors—requires more organization and publicity than a business man, like the writer, can provide in his spare time. Questionnaires were tried in the present study but, outside of Canada, old-fashioned letter-writing had to be used to gather data and enlist observation on published nesting sites. No other North American bird is surrounded by so much jealousy and suspicion, and the investigator repeatedly had to exhibit the three qualities which, according to Meredith (1934), the ancient Persians deemed so necessary in a falconer:

The first: that he have patience;

The second: that he be a good sportsman, and have a genuine love for his hawks;

The third: that he be good-tempered, pleasant spoken, and of a cheerful and cheery countenance.

As a basis for the present study, the history of each reported eyrie has been compiled for as many years as possible. These details, together with the locations of all sites reported, will eventually be filed with the National Audubon Society. There at some future date, it is hoped, they may be consulted by competent ornithologists who wish to study and evaluate subsequent population changes in this interesting species.

This report is, therefore, the result of a cooperative survey to which 146 people generously contributed in the past four years. For data and other assistance, the writer is especially indebted to Messrs. R. M. Bond, P. A. Dumont, A. F. Ganier, O. J. Gromme, S. C. Harriot, R. S. Harrison, R. A. Herbert, F. B. Lane, S. E. Perkins, 3rd, R. H. Pough, C. A. Proctor, J. N. Rice, 3rd, W. D. Sargent, W. R. Spofford, R. M. Stabler, P. A. Taverner, H. M. Van Deusen, W. A. Wimsatt, and the Royal Ontario Museum of Zoology. J. A. Hagar and Dr. Bond were a constant source of counsel and advice, although their own studies have not been used to influence any of the conclusions reached in this paper. Hagar's report on the number of occupied, extinct, and doubtful eyries now in Massachusetts has, however, been included. For additional criticism, the writer is also indebted to Professor Aldo Leopold and Dr. Ernst Mayr. The Hawk and Owl Society defrayed the not-inconsiderable costs of the author's postage, and Margaret Brooks typed various drafts of the present paper.

In addition to two years' preliminary field work, Herbert and Spofford conscientiously shared with the author intensive nesting studies which were carried out in 1939 and 1940 over an area of approximately 10,000 square miles (26,000 sq. km.) in Connecticut, New York, New Jersey, and Pennsylvania, hereafter referred to as 'around New York.' It is largely due to their inspiration and help that this supplemental part of the study was completed. In this connection we were also aided by Professor F. J. Trembley, and by members the Peregrine Club of Philadelphia and the Linnaean Society of New York.

#### BREEDING DISTRIBUTION

The known limits of *anatum*'s breeding range east of the Rockies were found to conform closely with those given by the A. O. U. 'Check-list' (1931) and by Bent (1937), but very little recent work has been done in the Far North. In the list of breeding localities quoted by the latter, eyries at (or near) Milltown, Bangor, Auburn, and New Haven are doubtful; those at Grand Manan, Talcott

Mountain, and Lehigh Gap deserted; those at Chickies and Neosho Falls probably deserted. Southerly, the range extends along the coast to the last fjord, in the Appalachians to Georgia, in the Mississippi Valley to Tennessee, and more westerly to the Big Bend country in Texas and possibly to Mexico. An adult, seen on June 27, 1939, by J. O. Stevenson (in litt.) at Santa Catarina, twelve miles west of Monterrey, Mexico, suggests that the present accepted southern limit may be subject to some revision.

In carrying out a census of the eyries of this subspecies, it was found that many sites were referred to by all kinds of aliases. This is largely due to the failure of observers to obtain the exact name of the cliff (some of course have none) and to the fact that their discoverers often refer to such sites by the name of the last community through which they happened to pass. A good deal of confusion has therefore occurred in avifaunal lists. Even in the banding files of the U. S. Fish and Wildlife Service this is creeping into evidence. One eyrie in New England now has no less than five synonyms, every one of them referring to the same cliff. The pair at this particular site is also so frequently molested that the birds spend many hours in each breeding season on an escarpment four or five miles (about 7 km.) distant. This habit has resulted in an additional eyrie being erroneously reported. Most situations did not reach this extreme, but many were cleared up by actual field work, while in other cases allowances were made for possible duplications.

#### NUMBER OF REPORTED NESTING SITES

Of the 408 reported nesting sites east of the Rocky Mountains, 67% are located in the United States (see Table 1). This preponderance may simply reflect the intensity of field work in the central and eastern parts of the continent, rather than the geographic indication of the species' center of abundance. It is hardly necessary to point out that Labrador and Greenland can scarcely claim even 1 per cent of the bird students, falconers, and egg collectors resident in the eastern States.

TABLE 1  
REPORTED EYRIES

	<i>U. S.</i>	<i>Canada</i>	<i>Labrador</i>	<i>Greenland</i>	<i>Total</i>
Previously published.....	167	65	7	5	244
Other sources.....	108	51	3	2	164
<b>Total.....</b>	<b>275</b>	<b>116</b>	<b>10</b>	<b>7</b>	<b>408</b>

## TYPES OF NESTING SITES

Peregrine nesting sites fall into four types east of the Rocky Mountains:

1. *Rocky cliffs, bluffs and escarpments* are by far the commonest now reported in use. (a) As a rule, these nests are on the escarpment itself, although occasionally the nest may be on the ground on top, and, on small cliffs, may be placed so much to the side of the cliff as to be almost off it. (b) Occasionally eggs are laid on cliffs in the abandoned nests of other large birds, such as the Red-tailed Hawk (*Buteo borealis*). A single egg is said to have been taken many years ago from an old nest of a Bald Eagle (*Haliaeetus leucocephalus*) in a great cottonwood in Iowa (Peck, 1924).

2. *Cut-banks* were frequently occupied west of the Mississippi River fifty years ago (no recent observations are available along the rivers involved) and are still used in Alberta (W. R. Salt, in litt.) and by *F. p. peregrinus* in northern Europe (Witherby et al., 1939).

3. *Gigantic trees* were nesting sites prior to 1880 in the Mississippi Valley; the birds used holes or nested on the tops of ancient sycamores and cottonwoods where the trunk had broken off.

4. *Man-made structures*.—In the eastern States, one pair (at least temporarily) deserted their ancient cliff and successfully nested on an abandoned stone-bridge pier which was isolated in the adjacent river (F. and J. Craighead, 1939). A second pair remained continuously for more than two years on a skyscraper in New York City, courting and copulating in season but not apparently laying any eggs (Herbert, Kassoy, in litt.). A third pair took up residence on a Canadian skyscraper and, under management, in their third year (1940) brought off two fledglings (J. D. Cleghorn, C. E. Hall, and E. W. Pfeiffer, in litt.). Abroad, the Peregrine occasionally nests on lofty buildings, and for many years resided on the spire of Salisbury Cathedral, England, where the birds were the special wards of the Dean (Butler, Matthews, et al., 1896–98).

## FACTORS AFFECTING BREEDING DISTRIBUTION AND DENSITY

No specific statement can be made at this time on all the factors limiting the breeding distribution of *anatum* east of the Rockies. Any bird that nests from the Rio Grande River to the Arctic Ocean obviously possesses ecological tolerances of a wide degree. Some of these will be more fully discussed by Dr. Bond in his report. The following may be mentioned here:

1. *Physiography*.—Because it now seems almost completely dependent on rocky cliffs and on cut-banks, the Peregrine's present distribution is confined to those regions where these are available. It appears, therefore, to be entirely absent as a breeder in such States as Ohio, Indiana, Illinois, Mississippi, Louisiana, and Oklahoma, and it is proportionately rare in Arkansas, the Dakotas, Manitoba, Saskatchewan, and Texas, which are essentially of the plains type.

2. *Cover*.—In the case of smaller birds, this term refers to hedge-rows, bramble patches, brush piles, etc., which offer the species protection from its enemies. In the case of the Peregrine Falcon, it is generally represented by the height of the nesting site. The primary function is the same in each case: isolation and protection from enemies. Peregrines frequently use their high cliffs as lookout perches, but this practice is not always possible at some sites. The species has been known to nest, for instance, in New York in a narrow ravine (Sargent, in litt.) and in a gully; among heather on small islets off the British coast (Witherby et al., 1939); and on the ground in the marshes of northern Europe and Asia (Kirkman, 1913). This factor is further discussed on page 196 of the present paper. Generally speaking, the minimum height acceptable to the birds varies inversely with the degree of wilderness to which the cliff or cut-bank is exposed and directly with the amount of molestation by man in the immediate vicinity of the nesting ledge.

3. *Egg site*.—The Peregrine appears to possess an absolute requirement in that the eggs must be laid in a hollow which is scraped out of dirt, gravel, or similar material. It is primarily the absence of this requisite which sometimes prevents these birds from adopting modern skyscrapers or similar structures as nesting sites. The falcons also prefer the shelter of an overhang (if it is available) or small vegetation. Spofford (in litt.) points out that very small cliffs with fine caves are occasionally used by this species, and that the high density of breeding birds on the inland cliff soon to be mentioned may be due to abundance there of deeply recessed ledges.

4. *Territorial competition*.—The entire foraging area is apparently not defended with this subspecies as it is with the Golden Eagle (Dixon, 1937) and many other birds. Near New York, in 1940, observations by R. A. Herbert and the writer indicate that mated males will defend the immediate vicinity of the nesting site against other males, migrating females, wandering females, and wandering young birds from adjacent eyries. Defense was found to approximate actual attack so closely that the use of a special formalized display for this purpose is uncertain.

Once when a resident male made a tremendous dive at a strange female which had soared toward his cliff (an hour earlier she had fed at another eyrie 1.2 miles—1.9 km.—away), she merely flipped over and presented her claws. The male swerved at the last moment and retired to his nesting ledge, while the female slowly soared eastward away from him (Brooks, Hickey, Wallenstein). This performance took place about 150 yards (140 meters) in front of a cliff on which eggs were being brooded; in two other cases, the pursuit of intruders did not extend beyond a quarter of a mile (400 m.) from the eyrie. Records of males defending territory against females are rarely found in the literature of any species. Herbert (in litt.) reports that a male, which was using a large gas-tank as a summer roost, was once seen to chase away an approaching female shortly before dusk.

Another interesting incident concerns the two pairs which were only one mile (1.6 km.) apart on a north-and-south river. On May 23, 1940, the male of the southern pair was found shot two miles (3.2 km.) north of the northern eyrie (W. H. Carr, in litt.). This bird was paired with a female which had failed to lay eggs.

That females will also defend the vicinity of their eyries against other females is evident from this observation by W. R. Spofford (in litt.): "On May 14, 1939, at the —— cliff, the tercel (male) came in from the east, followed by a falcon (female) about 100 yards (90 m.) behind. I presumed it was the pair. Actually, when the tercel prepared to alight, the resident brooding falcon (she had two young about two weeks old) came off fast at the interloper, which immediately reversed its direction, and the two birds disappeared after a rapid flight for some miles to the east. Ten minutes later the resident female returned to the ledge. Throughout this period the tercel remained on his perch, occasionally wailing."

There appears to be no regular spacing between eyries east of the Rockies. At one seabird colony in Canada, about a half-mile (800 m.) separates two pairs of Peregrines and about three-quarters of a mile (1.2 km.) separates a third pair (C. P. Grant, in litt.). Inland in New York the distance between two cliffs is estimated at 800 yards (730 m.) in one case; in another, the distance between ledges was paced off to about 1275 yards (1150 m.). The cliffs themselves, however, are generally separated by much greater distances than this. In one region of high Peregrine density, an average of about seven miles (11.3 km.) separates twelve eyries from one another (C. A. Proctor, in litt.). Since cliffs are so scarce, territorial jealousy is, therefore, a factor of considerable importance in restricting the density of nesting Peregrines. This is especially evident where a

long escarpment is the only available nesting site for twenty or more miles (32 km.) around. Many such places exist where only one pair is in residence.

When as much as a mile (1.6 km.) on each side of an occupied nesting ledge is not used by additional Peregrines, it does not necessarily mean that the entire escarpment represents the defended nesting territory of a single pair. One high inland cliff may be mentioned where five pairs of Peregrines reside on seven miles (11.2 km.) of escarpment. This fine series of cliffs may hold close to the maximum Peregrine density, and it is rather interesting to contrast its numerous, still unused ledges with the tiny gully which a sixth pair of these falcons uses some five and one-half miles away (8.9 km.). The high density here is evidently due to the geological character of this formation, which affords a wealth of superb caves and nesting ledges.

5. *Miscellaneous*.—Although their importance was not demonstrated in the course of this study, three possible factors may be mentioned in passing:

(a) *Competition with other species*.—The relation of the Peregrine Falcon to other predatory birds does not seem to be significant from a population viewpoint, the competition being confined to defense of nesting sites rather than food supply. A Peregrine may attack Ospreys (*Pandion haliaetus carolinensis*), Turkey Vultures (*Cathartes aura septentrionalis*), Bald Eagles, Red-tailed Hawks or Ravens (*Corvus corax*), but with most of these species it often dwells nearby with varying tolerance. It has also been known to breed on the same cut-bank with the Prairie Falcon (*Falco mexicanus*) (Salt, in litt.), and apparently on the same cliff with the Gyrfalcon (*Falco rusticolus*). Instances of the Peregrine killing Ravens, Red-shouldered Hawks (*Buteo lineatus*), and Snowy Owls (*Nyctea nyctea*) are well authenticated in the literature, but appear to be exceptional cases rather than the rule. Although Great Horned Owls (*Bubo virginianus*) were on or very near five of the nineteen eyries studied by Herbert, Spofford and the writer around New York, the exact relationship of these birds to the Peregrine was not satisfactorily determined.

(b) *Climate*.—The Peregrine is possibly affected by climate, for it is replaced in very dry country by the Prairie Falcon and in the Arctic by the Gyrfalcon. Lacking any familiarity with the distribution of the two latter species, the writer did not attempt to make any correlations with humidity, rainfall, types and densities of available prey, etc.

(c) *Food supply.*—At least in the East, this factor is very little in evidence. The Peregrine is probably attracted, however, to the great seabird colonies in the North Atlantic. At one such island, three pairs regularly nest, but their density per mile of available escarpment does not greatly exceed the density of similar escarpments inland. This may be due in part to the species' excellent powers of pursuit and capture, although some writers have overemphasized the latter. (R. A. Herbert and the writer once watched a pair fail seven consecutive times to effect a capture, although a total of over seventy-five racing pigeons passed their eyrie in a three-hour period when the young falcons were clamoring for food.) The species only rarely takes small mammals. Because its food was found to spread over so many species of birds, it is not expected that population curves in any given kind of prey would seriously affect the numbers or distribution of this predator.

#### POPULATION FLUCTUATIONS

##### A. AGE OF PRESENT NESTING SITES

The tenacity with which successive Peregrines cling to the same nesting site is well known. East of the Rockies, twenty eyries have a history exceeding ten years; fourteen exceed twenty; seven exceed thirty; eleven exceed forty; and fourteen exceed fifty years. Most of the remaining cliffs occur in regions where observers are few and observation is infrequent. At least one eyrie can be traced back for over a century, and it is certain that many others are almost ageless in their antiquity. Modern British falconers have, for instance, taken fledglings from an island eyrie which was famous in Elizabethan times (Blaine, verbally).

##### B. DESERTED EYRIES

Is the Peregrine Falcon decreasing? About fifty per cent of the reported eyries were definitely occupied at some time during the past decade. Because the area involved in this survey is so large, it was impossible to enlist field work to check all the remaining locations. Actual allegations of eyries being no longer in use are confined to approximately forty-five sites, all but one of which are in the United States. These may be broken down into three classes (see Table 2) according to (a) the total number of eyries reported, (b) a total of all deserted eyries plus 210 known to be in use, and (c) a total which includes those known to be in use but does not consider twenty which are possibly deserted.

TABLE 2  
DESERTED EYRIES

	Possible	Probable	Definite	Total
<i>Reported deserted</i> .....	20	8	17	45
(a) Compared to 408 disc'd.....	5%	2%	4%	11%
(b) Compared to 255.....	8%	3%	7%	18%
(c) Compared to 240.....	—	7%	3%	10%

It will be seen that on the basis of these data, eighteen per cent represent a maximum decrease in the Peregrine population and ten per cent a minimum decrease within recorded times.

1. *Possibly deserted eyries*.—There is ample reason, in the writer's experience, for believing that random checking of a Peregrine nesting site can lead to wrong conclusions about the absence of breeding falcons (especially if the observer fails to climb the cliff). Classified under the 'possible' category are cliffs where systematic observation is lacking as well as those where the correspondent concerned was not personally known to the author. Among the twenty here included are two in Minnesota (W. J. Breckenridge), four in Colorado (R. J. Niedrach), six in Missouri (R. Bennett), and seven in Vermont (G. H. Ross). The failure of falconers in Colorado to re-locate nesting Peregrines is one of the surprises in this survey. One cannot accept the theory that these men are less efficient afield than the old-time collectors and it may be possible that within the past fifty years ecological changes there have favored the Prairie Falcon at the expense of the Peregrine.

2. *Probably deserted eyries*.—Only tree-nesting pairs have been included in this category. Robert Ridgway (1895) found three of these in the spring of 1878 immediately about Mt. Carmel, Illinois; two more records appear to be his from the Wabash river-bottoms in Indiana; while at least two and possibly three pairs were found by Col. Goss (1878) near Neosho Falls, Kansas, at about the same time. These interesting birds may have been remnants of a considerable Peregrine population. Their habits and localization may be compared to those of the Peregrines that still use old bulky nests in trees in some parts of Germany, in contrast to the Peregrines of the British Isles where only cliffs are occupied—although abandoned nests of the same raptore (Falconiformes), crows (Corvidae), and herons (Ardeae) are also available (Witherby et al., 1939). It should be noticed that tree-nesting individuals in the European race (*F. p. peregrinus*) use the abandoned nests of other large birds, while *anatum*, with one possible exception, utilizes only cavities and broken-

off trunks. Only one or two tree-nesting examples are currently known to exist in North America and it took an earthquake to flood their territory in the Mississippi Valley and save the virgin timber from the lumbermen (Ganier, 1932).

3. *Definitely deserted eyries.*—All of the seventeen sites that were recognized in 1940 as definitely abandoned eyries have been deserted for at least three years. Five of these became extinct before 1915, and four more between 1930 and 1937. The history of the remaining eight suggests that they were not always used by Peregrines and that they may be called 'temporary' eyries—a term offered by J. A. Hagar (in litt.). All but one of these became deserted since 1929.

#### C. NEWLY USED EYRIES

Although 143 new nesting sites have been discovered east of the Rockies within the past decade, there is no evidence to indicate that any appreciable number of these had just been taken over by Peregrines. Indeed, a great many had unquestionably been overlooked by ornithologists for years. No lists, however, were left by the egg collectors of the past to show the cliffs which Peregrines were *not* using at that time. One temporary eyrie was definitely taken up in 1933 (J. V. Sparmaker *vide* F. Schmidt, in litt.) and another small cliff was taken over by a new pair in 1940 (N. Wight, in litt.). Four abandoned quarries have also been occupied, but two of these are now deserted. The two pairs on skyscrapers have already been mentioned. There is no question, then, that at least minor fluctuations exist in the population, but up to the present they have been surprisingly hard to detect. In New Hampshire, Vermont, New York, Connecticut, New Jersey, and Pennsylvania, where the Peregrine has been intensively watched, one temporary eyrie exists for about every ten permanently used sites. In the case of six such eyries within a wide circle around New York, no more than two were occupied at any one time in the last fifteen years. It is the writer's conclusion that in the six States just mentioned the number of pairs on territory at the start of each breeding season is remarkably constant from one year to another. A similar situation has been reported in certain passerine species elsewhere over four- or five-year periods; cf. Parula Warbler (*Compsothlypis americana*) and Black-throated Green Warbler (*Dendroica virens*) studied by Cadbury and Cruickshank in 'Bird-Lore's Fourth Breeding-Bird Census' (Hickey, 1940).

## D. REPLACEMENT OF MISSING BIRDS

The speed with which missing birds are replaced at eyries is a widely attested character of the Peregrine population both here and in Europe. There is a British record (Witherington, 1909) of a female replaced within thirty-six hours of her death, and at one Canadian site the adults were replaced so quickly that two new birds eventually raised a brood that neither had parented (Taverner, in litt.). These and countless less spectacular observations could imply the existence of a mobile non-breeding population of considerable importance to the species. As a rule, missing birds are replaced by at least the start of the next breeding season. Within recent years, the loss of both male and female within a two-year period failed to disrupt the annual nesting at one Maryland eyrie (W. A. Wimsatt, in litt.); a Vermont pair was shot and replaced in about two weeks (C. A. Proctor *fide* Van Deusen verbally); and a New York male probably passed one season before finally pairing with an immature female early in April.

Quick replacements at the start of the breeding season can, of course, be effected by migrating birds. Spectacular replacements later on in the nesting cycle seem to the writer to be due to the presence of nearby Peregrines which have encountered some disaster at their own nesting sites. There are two reasons for this hypothesis: (1) unpaired birds are rarely seen or recognized in the breeding season (in cities like New York and Philadelphia where they winter in numbers, their presence would be conspicuous); (2) nesting birds that lose their eggs, often desert their eyries. Green (1916) reports that a male *F. p. pealei*, which he collected in British Columbia, was replaced within forty hours by one apparently from an eyrie a couple of miles (3.2 km.) away. During the wet, disastrous season of 1940, when four clutches around New York disappeared from open, exposed ledges, one female was actually driven off its eggs by an intruding bird of the same sex. Although this second falcon was thus able to satisfy its brooding drive, the thirty-day-old eggs chilled in the contest. A week later they were still in its possession with their rightful owner still in the vicinity (Spofford et al.). There were two pairs which had unsuccessful seasons in this vicinity and from which this intruding bird could have come, one five and one-half miles (8.8 km.) away, another about eight miles (12.8 km.) away.

## FACTORS AFFECTING SURVIVAL

## A. EGGS AND YOUNG

Pertinent life-history statistics have been compiled from the entire region considered in this paper, and they should make an interesting comparison with the data being separately accumulated by J. A. Hagar in Massachusetts.

1. *Clutch*.—There is no doubt that over most of the Peregrine's range, here as well as abroad, the normal clutch is four, and that clutches with fewer eggs are often due to premature collecting, second sets, and (rarely) interruptions by storms. There are several instances where the falcon is known to have laid a single egg in one scrape and then laid the remainder of her clutch in a different scrape on the same ledge or a different ledge on the same cliff.

TABLE 3  
DATA ON CLUTCHES

Number in Clutch	Number of Sets Reported			<i>Total</i>
	<i>U. S.</i>	<i>So. Canada</i>	<i>Arctic</i>	
2.....	14	5	5	24
3.....	75	4	12	91
4.....	175	11	4	190
5.....	13	2	—	15
6.....	4	—	—	4
7.....	1	—	—	1
 Total.....	 282	 22	 21	 325
Mean clutch average...	3.72	3.5	3	3.65

Where second sets were known to the collector, they have been omitted from Table 3, which summarizes the clutch data so far available. Like all other Falconiformes the Peregrine is, of course, single-brooded. If the eggs are lost at a rather advanced stage of incubation, or if the young are lost, no further attempts at nesting are known to have been made by the same pair until the following season.

2. *Hatching success*.—The interesting possibility that in the North the Peregrine lays fewer eggs (see Table 3) is substantiated at least in part by the hatching successes summarized in Table 4. Unfortunately the Canadian samples in both cases are small, while the Arctic records are almost negligible. This trend is directly opposite to the late Rev. F. C. R. Jourdain's belief that the largest clutches of eggs are usually found in the North (Boyd, 1936). Since the Swallow Inquiry of the British Trust for Ornithology (*op. cit.*) clearly demonstrated for at least one passerine that broods in northern

localities possess the largest number of young. Jourdain's generalization probably covers only multi-brooded species.

TABLE 4  
HATCHING SUCCESS

<i>Number young on ledge</i>	<i>U. S.</i>	<i>Number of reports</i>			<i>Total</i>
		<i>So. Canada</i>	<i>Arctic</i>	<i>—</i>	
1.....	2	1	—	—	3
2.....	28	13	—	—	41
3.....	58	6	2	—	66
4.....	34	5	1	—	40
5.....	2	—	—	—	2
<b>Total</b> .....	<b>124</b>	<b>25</b>	<b>3</b>	<b>—</b>	<b>152</b>
<b>Mean average</b> .....	<b>3</b>	<b>2.5</b>	<b>—</b>	<b>—</b>	<b>2.8</b>

It will be seen that the difference between 3.65 eggs (the mean average clutch for the total area) and 2.80 fledglings (the mean average hatch for the same region) is 0.85, a drop of 23.3%. In other words, about one egg in every set fails to hatch. This failure is the first indication of a long series of decimating factors which cut down sharply the breeding potential of this species. Several correspondents state that infertility of one egg in every set is "not uncommon." However, an analysis of ninety-five records by egg collectors shows that only 7% of their sets contained one infertile egg, while 4% of such sets were addled. (About 31% of these sets were freshly laid, and 58% were incubated in various degrees.) In discussing this situation in the British Isles, H. A. Gilbert (in litt.) writes: "It is very rare to find an infertile egg—and I am convinced that at least 95% . . . are hatched unless cracked by falling stones or upset by human interference." Hagar (in litt.) suggests that future reports of infertile eggs be accompanied by specific reasons why such eggs could not be considered merely addled.

3. *Nest losses*.—Beyond the vast amount of egg collecting which once was so popular in the East, very little data are available on egg losses. Incomplete clutches may be abandoned if exceptionally nervous birds are molested. In one extreme case, the falcon deserted when the observer cautiously poked his head over the cut-bank which she shared with a Prairie Falcon and two other hawks (W. R. Salt, in litt.). Sometimes an egg is broken as though it were kicked. Eggs may disappear one at a time, or a whole clutch be gone after a week's interval. During the wet season of 1940, the latter took place on four of the five exposed ledges around New York, whereas

the cave-nesting birds there showed a high nesting success. While one might charge the disappearance of the sets to crows (no fragments were found), it seems equally possible that the birds may have abandoned the eggs first, or that they were washed away by storms. One female, for instance, was actually found a day after a heavy storm, to be brooding her eggs in a light stream of running water. Undue molestation by picnickers and workingmen may have been a contributing factor in three out of four of these cases. At one Virginia site, an opossum (*Didelphis virginiana*) is said to have taken all the eggs (E. J. Court vide Wimsatt, in litt.), while at one New England eyrie, some animal, perhaps a raccoon (*Procyon lotor*), once ate all the young (J. N. Rice, 3rd, in litt.). While second clutches are frequently laid when a set is taken by a collector, they are often conspicuously absent after the loss of the first set through some of the disasters mentioned above.

There are two records of fledglings falling off the ledge at an early age, and two reports of fledglings dying on the ledge. Heavy infestations of *Protocalliphora* were noted at three nests in 1940, and it was at one of these that a fledgling died. This bird, a female, was raised in an extremely damp situation and death may have come from a fungous condition of the throat (W. D. Sargent). In three reports of young birds being shot on their nesting ledge, the gunners are given as a game warden, a pigeon fancier (the ledge contained a number of racing-pigeon bands), and an unknown party. At one site in Kentucky, mountaineers claim that, while they have not been able to hit an adult, not a single young bird has left the local eyrie in recent years. As soon as the fledglings walk out on their nest ledge, they are shot off (A. F. Ganier vide Spofford, in litt.). Immediately after they leave their parents, young Peregrines enter a critical period when their powers of pursuit and capture are not fully developed. It is at this stage that they have turned up (according to pictures in the public press) in the basement of a Philadelphia skyscraper and in a barrel on the upper floor of a barn in New Jersey.

*Productivity samples*.—Although as many as ninety cliffs were visited in a single season by the writer and his cooperators from Quebec to Maryland, the fairly complete nesting history was worked out for only one region—around New York. At nineteen occupied sites, an average of about 1.1 birds was fledged over a two-year period (see Table 5). These results were based on what is felt to be one normal season (1939) and one subnormal season (1940) in one region only. In 1940, scattered reports from central Pennsylvania sug-

gested that the birds there had no better success than those around New York. At the same time, Herbert and Spofford found six out of eight eyries in New England with eggs or young—a much better reproductive rate than elsewhere experienced, although their sample is admittedly a small one.

TABLE 5  
SAMPLE REPRODUCTION

	1939	1940
Sites studied . . . . .	23	23
Deserted . . . . .	4	4
Permanent eyries . . . . .	2	2
Temporary eyries . . . . .	2	2
Occupied by one or more birds . . . . .	19	19
No eggs laid . . . . .	5	4
Results inconclusive . . . . .	1	3
Nesting successful . . . . .	10	6
Number of young raised		
Probably hatched . . . . .	30	15-16
Died on ledge . . . . .	1	1
Disappeared . . . . .	1	1
Probably fledged . . . . .	28	12-14
Young raised per occupied site . . . . .	1.5	.7

The details of these two seasons are rather interesting, and the results for a given eyrie may be seen by reading from left to right in the following columns:

1939	1940
2 old eyries were deserted	2 old eyries deserted (one had not been checked in 1939; one from 1939 was not checked in 1940)
2 temporary eyries were deserted	Same 2 still deserted
1 male present, apparently unmated	This male had a one-year-old female; no eggs laid
3 females failed to lay; a fourth female on a skyscraper very likely did not lay either; all were paired	Same 3 females without eggs; skyscraper pair disappeared about time of egg-laying
1 set and female disappeared	Same female or her successor disappeared and the eggs chilled
1 set was collected; 1 young hatched from second set but was shot before it flew	Set was marked on open ledge but disappeared
4 young at one site disappeared mysteriously	Eggs chilled when intruding falcon drove off owner
10 pairs raised young; as 8 had 24 fledglings, the total hatch was probably 30; observations on one additional pair were incomplete	3 sets disappeared and the pairs deserted
	Observations on 2 eyries were incomplete
	6 pairs raised young; of these 4 hatched 10 birds; hence the total hatch was probably between 15 and 16

During 1940, two adult males in the above sample were shot by gunners. One belonged to a non-breeding pair and was found dead late in May about three miles (4.8 km.) from the eyrie. It was replaced by another male within six weeks. The second male was shot early in the season and died about four feet (1.2 m.) from the scrape in which his mate was brooding approximately ten-day-old eggs. This female continued to brood her clutch, fed herself, and, in about two weeks, secured the attendance of a new male. She successfully hatched the eggs and her young flew off without further disorder. This incident occurred in a region of high density (previously mentioned) where several pairs were experiencing unsuccessful seasons.

4. *Sex ratio*.—Reports were received mostly from falconers on 114 fledglings seen on nesting ledges. These were given as 61 males and 53 females (53.5% and 46.5%). These figures cannot be regarded as significant, unfortunately, because not all Peregrines can be sexed on the basis of size alone. The margin of error in these cases, as Herbert (in litt.) estimates, may run from 10% to 20%. Frequent statements in the ancient literature of falconry refer to a widespread belief that there are two females to every male (hence the word tercel). Modern falconers are reluctant to take all the young from an eyrie, but in five cases where this was done and the birds were raised to maturity, the sex ratio was given as six males to nine females. F. B. Lane likewise reports (in litt.) this ratio as seven to twelve at seven nests which he visited, and Herbert and Spofford as ten to eighteen on their banding excursions. What effect the frequent loss of one egg in each set has on the sex ratio at birth therefore remains uncertain. Conclusive data on the sex ratio of adults are also lacking. As far as is known, the birds are monogamous.

5. *Age of females*.—The relationship of age to fertility in the female is worthy of consideration. Three reports state that mated one-year-old females failed to lay any eggs. A fourth describes an immature falcon that brooded a clutch of two. While it is probable that these were her own eggs, actual proof is lacking. Considering the two-year sample around New York, only one out of thirty-four females was a first-year bird. At one New Jersey eyrie, during the past decade, Herbert (in litt.) believes that he recognized two females in different years as two-year-old birds. Each significantly laid a clutch of two eggs.

Of even more importance, however, is the presence of females that fail to lay year after year. This situation seems to hold at one eyrie for most of the last ten years, and it is unquestionably true at

two other sites from at least 1938 to 1940 inclusive. These last two eyries were subjected to intensive watching by the writer in 1940 in order to make sure that no eggs were being taken by predators or egg collectors. In each case, courtship by the male lasted at least one month past the normal period. To the tercel's displays, the falcon was generally unresponsive, although she came to the cliff for food and sometimes permitted copulation. As this apparent sterility occurred in three out of about eighteen cases (16.6%), its occurrence takes on considerable significance. It seems likely that this condition may be brought on by old age.

Up to the present very little data have been published on this subject. McLean (1930) has concluded that very old and sexually spent California Quail (*Lophortyx c. californica*) form non-breeding coveys on high ridges apart from the younger birds. Harlow (1922) has stated his conviction that some Ravens (*Corvus corax principalis*) failed to lay year after year, like the falcons just described. He cites one pair which rebuilt the same nest from 1912 to 1918 but failed to lay, and describes other non-breeding pairs which "exhibited every solicitude at the presence of intruders." The male Peregrines scraped courtship hollows on the ledges early in the season, but the females were often away from the cliff for hours at a time and, beyond coming to the cliff for food cached by the male, exhibited little concern when molested. It may or may not be significant that evidence of approaching sterility is practically unreported by eastern egg collectors. In 1939, however, one set was taken in which three of the four eggs were infertile and rotten (Brockway, 1939). This particular female hatched only one egg from her second set. Her 1940 eggs disappeared (W. D. Sargent, verbally).

#### B. ADULTS

1. *Mortality*.—Man is the adult Peregrine's worst enemy. Birds are shot at all seasons, in States that protect them as well as in those that do not, on private lands and on public reservations. This shooting has somewhat decreased in recent years, especially since the abolition of shorebird gunning, but it is still carried on by hunters, by boys, and by game protectors. The number killed by farmers is apparently small (about two out of every hundred pairs ever taking poultry), the number killed by game wardens rather marked, although, in the East at least, game is a very rare item in the Peregrine's diet. While parasites might be regarded as enemies of potentially great importance, only two reports reached the author regarding migrating birds which, it was said, became incapacitated by disease.

2. *Life expectancy.*—The life expectancy of these birds has not yet been established by banding, since most recoveries of marked fledglings occur in the birds' first fall migration. Breeding adults are not infrequently distinguished for three to five years at some particular eyrie by special characteristics, such as their behavior or the color of their eggs. In New Jersey, one resident male was recognized by R. A. Herbert (in litt.) at the same cliff for ten or eleven years.

#### CONSERVATION AND MANAGEMENT

Before discussing problems of conserving this species in the area east of the Rockies, it is necessary to review some general characteristics of the population, to dispel certain exaggerated conceptions about egg collecting and falconry, and to emphasize the importance of the nesting site in the Peregrine's annual cycle.

##### A. SOME GENERAL POPULATION CHARACTERISTICS

Peregrines, as we have already seen, tolerate wide extremes in climate, but as a rule are extremely limited in their present choice of nesting sites. The great mobility of the adult birds and the relative ease with which they secure food have apparently modified territorial competition to the point where only the immediate vicinity of the nesting site is defended. The present-known maximum number of breeding birds per unit of space is best expressed in linear terms—one pair per approximately 1.4 miles (2.25 km.) of ledge-studded escarpment. The birds can tolerate considerable changes in their environment. This is certainly true in respect to their foraging area, but is only partly true in regard to their nesting sites. Some pairs now hunt almost exclusively over cities; many have suffered the construction of highways and railroads immediately below their nest ledges; and one pair (and its successors) tolerated for over a century the activities of a village of two hundred people at the base of their eyrie. As a general proposition, Peregrines appear to be little molested by the progress of what passes for civilization below their cliffs, but frequent or prolonged visits by human beings to the top of an escarpment or cut-bank may bring about interruptions in the breeding cycle, and in some cases actual desertion of the eyrie.

It is rather difficult to make any statement regarding the smallest-size cliff that a pair of Peregrines will use year after year. Perhaps seventy-five feet (23 meters) constitutes the height of the smallest cliff now known to be occupied. This would suggest that many small cliffs located in towns and villages, possessing adequate egg sites in the form of caves or ledges, may have been used by these birds be-

fore the arrival of the early settlers. A good example of such cliffs would be those in the city of New Haven, Connecticut. The smallest escarpments now in use are in wild country or overlooking long talus slopes. In a few cases, birds are really nesting on large outcrops which protrude above the tops of trees and possess perfect nesting ledges or caves. Minimum requirements, it would thus appear, are more qualitative than quantitative. Ideal requirements will be discussed in the section which follows.

It seems impossible, on the basis of present data, to ascertain even approximately the number of Peregrines which any given environment can carry. The general absence of this species in winter north of a line running from Colorado to Massachusetts may indicate, however, that the winter population of prey to the north approaches or is below the minimum limit for this predator's survival. It would be interesting to work out the density of available prey in those States and Provinces where the Prairie and Peregrine Falcons live side by side as well as in those regions where the former replaces the latter.

#### B. EGG COLLECTORS

Peregrine egg-collecting east of the Rockies is gradually dying from old age. In this region, only six or ten such persons are still active. Compare this to fifty years ago when at one popular eyrie, according to Frick (1883), over thirty people climbed one cliff on the same day for a single clutch of eggs. If eggs are taken, the birds usually but not invariably lay a second clutch in the United States but rarely in the Canadian provinces. That these sets contain fewer eggs can be seen in Table 6.

TABLE 6  
KNOWN SECOND SETS

No. in clutch	No. sets reported
2	2
3	16
4	2
5	1
6	1

The average second clutch being three, there is some evidence that the hatch is usually two, so that collecting in the past cut down the breeding potential of these birds by at least 33% from normal. Permanent desertion of a cliff has coincided with a collector's visit in only one known case. It may or may not be significant that Vermont, which has undergone some of the most intensive egging

in the East (over fifty sets taken between 1920 and 1934), now is said to have so many deserted eyries. Until actual facts on the homing of fledglings are available, the exact effect of this egg collecting must remain hypothetical. Although it is still occasionally practiced in States that protect the species as well as on public reservations, the total amount east of the Rockies is now relatively negligible. Failures to locate Peregrine eggs in the past were generally charged off to some earlier visit by a collector. While this assumption was probably correct in many cases, it has completely obscured the losses of eggs through natural causes and the apparent sterility of aged females.

#### C. FALCONERS

Falconers, on the other hand, are a group that is slowly but steadily growing. It is time that conservationists realize the true significance of this movement. As one who is interested only in falcons and not in falconry *per se*, the writer would like to record briefly these seven observations on the movement in America up to the present time:

(1) Falconers constitute, by a wide margin, the most rabid admirers of hawks in our country today. It is not a fad of the wealthy, but a hobby of the middle classes involving considerable devotion and work. The vast majority of its members are sincerely interested in hawk conservation; a few exceptional individuals cannot be trusted.

(2) The term 'falconer' at present is generally applied without distinction to those who are essentially pet-keepers, as well as to those who train their birds to fly and hunt in cooperation with man. Most of them are probably genuine conservationists, but only a few are real falconers.

(3) In most of the East, the wooded terrain is only suited to hunting with accipitrine species like the Cooper's Hawk (*Accipiter cooperi*), but this fact is seldom appreciated by novices who take up the sport in this region.

(4) Peregrines, because of this situation and their great glamor in the Old World literature, are over-rated, and a number of experienced falconers upon recognizing this have turned to hunting with the Goshawk (*Astur atricapillus*) or the Cooper's Hawk.

(5) Falconers are extremely valuable propagandists for hawks, especially among sportsmen and farmers, but their services are not organized nor uniformly directed.

(6) The number of birds used in falconry every year is still relatively small and under experienced hands the number that escape

to the wild is relatively large. Beginners, however, frequently lose their birds by disease or accident. Although veteran falconers unanimously believe that their escapes quickly become self-sustaining wild birds, no bird banding has been done to support this opinion.

(7) Boys or young men, untutored and inexperienced, may constitute a problem in the future, but this is perhaps an improvement over former times when youngsters of a similar age were ruthless users of the gun or rabid collectors of eggs. Up to the present time, the one eyrie which Peregrines have deserted due to abnormal molestation by young falconers happens to have been a 'temporary' nesting site.

#### THE NEST SITE AS AN ECOLOGICAL MAGNET

A fundamental concept in any consideration of this species' conservation revolves around the fact that cliffs are the dominant features of the Peregrine's ecological niche over most of its present breeding range, and that these cliffs attract the falcons in widely different degrees. It is rather well known that trees, buildings, or shrubbery possess this same basic faculty for other species, though often more subtly. General statements about the toleration of man's activities by Peregrines depend largely on the types of cliffs which various pairs occupy.

1. *First-class Peregrine cliffs* are *extremely high*, often rather long, usually overlooking water, and generally dominating the surrounding countryside. These so attract this species in the breeding season that Peregrines will apparently occupy them *no matter how many 'nests' are broken up or adult birds destroyed*. There are numerous examples of this principle. At one eyrie, a nearby pigeon fancier is said to have repeatedly tried to kill off the resident birds without success (Nye, verbally). All the fledglings at this same site were taken by young falconers and natural predators from 1936 to 1940, but adult birds are still present (Wimsatt, in litt.). This cliff not only has a railroad at its base but a large sign has also been painted across its surface. At another site, both first and second sets were taken for ten successive years, yet the birds failed to desert (Bagg and Eliot, 1937). Rowan (1921) has cited the perfect illustration of this ecological magnet in his description of a patch of old heather which was used for nineteen successive years as a nesting site by Merlins (*Falco aestivalis*). Although there were a score of other patches on the moor that these Merlins could have used, the birds always chose this particular one in spite of the fact that *every year the nesting pair was shot and not a single egg hatched*. At least in the cen-

tral and northern parts of the Appalachian system, first-class cliffs can be recognized by their size alone, and solely on the basis of similarly large cliffs in the United States, Capes Trinity and Eternity, where the Saguenay enters the St. Lawrence, can be given as examples.

2. *Second-class Peregrine cliffs* differ from the above merely in their dimensions. Here, the birds can withstand considerable molestation. Death of one adult does not necessarily cause the abandonment of the eyrie, but death of both adults may leave the cliff without birds for an indefinite time. Picnickers on top of the cliff will often create complications. These persons are generally absent early in the nesting cycle, so that their presence later on in the season affects the behavior of the female about the time that the eggs are hatching. At one eyrie of this class, the brooding bird has been frightened off so many times that only one egg has hatched in nine years. At this site, after the female deserts in May, the male takes to roosting on a gas tank about seven miles away, yet at the start of each breeding season a pair is again in residence (Herbert, in litt.). Such behavior varies according to individual birds and according to the location of the eggs—whether they are near the top, on an open ledge, in a cave, etc.

3. *Third-class Peregrine cliffs* are small, not very high, although they may be far up a long slope, and they may or may not overlook water. They may be regarded as the marginal niches in Peregrine ecology. Because the birds at such sites are the most responsive to molestation and persecution, these cliffs are the present crux of the conservation problem to preserve Peregrine eyries in civilized areas. The death of one adult may result in permanent desertion of the cliff by its mate. Picnickers on top of the cliff may cause desertion for the rest of the breeding season or for an indefinite period. Since these cliffs are not very high, the amount of cover they provide against the depredations of man is measured to a great degree by the wildness of the general region. As already stated, in the nesting site of the Peregrine Falcon, height and wilderness are the two components of cover.

It should be mentioned that this classification of ecological niches does not consider them in the sense that some attract more pairs of Peregrines at one time than others. Variations in individual behavior and a superabundant food supply both probably narrow the size of the nesting territory defended, and one would expect the latter to be a factor in maintaining some cliffs as first-class eyries. This is probably true of those sites which are adjacent to or a part of the great seabird colonies. Although the density of the surrounding

bird population may vary from 200 to 800 birds per hundred acres inland, there is no indication that this variation has any appreciable influence in determining the classification of neighboring eyries. One would also expect that any classification along these lines is influenced by altitude and by temperature at the periphery of the species' range where large cliffs cannot be classified as of the first class. Field work up to the present indicates that optimum breeding range extends in the East at least from Maryland to the Laurentian shield. In a superficial analysis of over fifty Appalachian eyries by Herbert, Sargent, Spofford and the writer, all three classes were represented equally. This representation will, of course, vary from region to region.

Bennett (1938) has pointed out that a more balanced sex ratio exists in the southern part (Iowa) of the Blue-winged Teal's (*Querquedula discors*) range than in the northern part (Saskatchewan). He suggests that the unmated males may move on to the northern breeding grounds. There is no available evidence that a similar situation exists with the Peregrine Falcon. As a general but by no means invariable rule, gaps in the population are filled according to each eyrie's value as an ecological magnet, and not according to latitude. It would follow from this principle that pairing in the Peregrine Falcon is not based on sexual selection but rather on the selection of a nesting territory. This deduction should not be accepted without much more intensive study. What we do know is that disaster to one adult at a third-class cliff will often cause the remaining adult to desert. When a bird is shot at a first-class cliff, the survivor generally succeeds in obtaining a new mate by the start of the next breeding season. Females will often desert second-class cliffs where males show a tendency to remain.

#### ACTUAL SIZE OF THE TOTAL POPULATION

Another important conservation concept concerns the actual number of Peregrines breeding regularly east of the Rockies. That the discovery of new pairs has not yet been affected by the law of diminishing returns may be seen from Table 7.

TABLE 7  
DATES ERYIES WERE DISCOVERED

	<i>U. S. The North</i>		<i>U. S. The North</i>	
1840-49	3	1	1890-99	27
1850-59	2	-	1900-09	18
1860-69	4	8	1910-19	21
1870-79	15	3	1920-29	42
1880-89	24	6	1930-40	107
				36

The total population is, in the writer's opinion, far in excess of previous estimates. West of the Appalachians, where the bird breeds so much on river bluffs and cut-banks, a lack of systematic observation makes a tentative estimate impossible at this time. Sixty eyries have been reported there in the past and many times this number must exist. The density in this area greatly increases as one turns north into Alberta. For the Appalachian region, where over two hundred pairs have been reported, a tentative estimate can be made with more confidence. Although three of the States here contain 100 known eyries, the rate at which new locations are still being reported even in these areas is very impressive. The field work is still random in character and carried out only on week-ends for a limited time each year. A tentative estimate would place the breeding Peregrines in the eastern States at perhaps 350 pairs, but the amount of unexplored country in both West Virginia and Maine renders this figure more of a guess than a statement supported by satisfactory facts. East of the Rockies, the real center of abundance may lie farther north. Available data only indicate that the density in the Appalachians does not diminish in the Laurentians. The possibilities in Greenland are only hinted at; although only seven eyries have been so far recorded on its rugged coasts, twenty-five fledglings were recently sent to Finland from a single port (Meredith, verbally).

The existence of a large population in Canada and the Arctic has not, however, been supported by the migration data of ornithologists in Canada or the United States. At Cape May, New Jersey, where observations each fall have been made daily by Audubon wardens for a number of years, less than one hundred birds constitute the total known flight for each September and October (R. P. Allen, in litt.). This puzzling situation may be solved by the field work of other observers now in progress at seemingly richer observation stations along the Atlantic coast.

#### RECOMMENDATIONS

So many writers have eulogized the Peregrine Falcon as the most spectacular example of winged predation that no justification for its conservation is necessary in the present paper. The population is thinly distributed over an immense area and is very gradually decreasing in the more settled civilized regions. The necessity of preserving individual breeding pairs as permanent parts of each local avifauna is therefore a real one. Without the special protection which has been given them, half of the eyries in Massachusetts would, in the writer's opinion, today be deserted. This indeed has already

taken place in Connecticut, where two long-used cliffs are now abandoned and a third, though occupied, has failed to produce young birds for the last five or six years. Certain recommendations are therefore in order.

1. The name 'Duck Hawk' upon extensive study proves to be logical only very locally, and is actually a misnomer over most of the species' range east of the Rocky Mountains. From a conservation viewpoint, the very connotation of this name stimulates a vast amount of wholly unnecessary prejudice. The writer would earnestly recommend to American ornithologists that they follow their sensible Canadian colleagues in calling this bird the 'American Peregrine Falcon,' or simply the 'Peregrine Falcon.'

2. Inclusion of this falcon among the protected species of each State is another important preliminary step in protecting both the birds and their eyries. Only nineteen States now do so, although the effect of the birds on game or other avian populations is obviously a negligible one. The Peregrine is not protected in Canada, although its admirers there are numerous.

3. The preservation of individual eyries is a local matter which involves a local approach. No amount of work for the protection of these birds along their migration routes or on their widely scattered wintering grounds will be effective unless this breeding stock is conserved. State legislation helps but it is only a start.

(a) Talks to the owners of occupied cliffs have value in the long run. When interviewed, most owners are impressed with accounts of the Peregrine's relative rarity, with its reputation as our fastest-flying bird, and with its historical background. One's main purpose in such discussion should be to keep picnickers away from the cliff at least until the eggs are hatched (May 15 in Maryland, June 1 in New Jersey, and June 15 in Quebec). It is also important to eliminate gunning in the vicinity of the eyrie. Special sanctuary signs can be obtained without charge from the Hawk and Owl Society by applying to the writer.

(b) Game wardens, who generally carry guns at all seasons, are also important subjects for education. One of these is said to have brought on the desertion of New England's oldest-known site—a second-class cliff in Connecticut—by shooting both adult birds and their young (Spofford, in litt.). Some States, like Maryland, still regard the Peregrine as vermin, and there wardens destroy this species at every opportunity. It is suggested that persons, who learn at first-hand of game protectors molesting these birds, communicate

their observations to R. H. Pough, National Audubon Society, 1006 Fifth Avenue, New York City.

(c) Perhaps the most effective way for conservation groups to preserve Peregrines as permanent parts of their local avifauna lies in the appointment of volunteer custodians who will watch neighboring eyries, report yearly on the status of the birds, and communicate at once to the Hawk and Owl Society (in care of the writer) any illegal or prejudicial interference which is taking place.

(d) At eyries where special problems of predation arise, such as the birds taking valuable poultry or racing pigeons, this pressure can at least partially be reduced by placing the fledglings in another 'nest.' In 1940, Herbert and Spofford moved two such nestlings to a State where they were protected. Although about ten days younger than the two fledglings already on the new ledge, the transported birds thrived in their new environment.

4 As an education measure of considerable potentiality, the writer would also suggest that in States where the Peregrine is protected the keeping of such birds in captivity be permitted under license for lecture purposes, that falconers be required to carry out this obligation, and that in return recognized hunting privileges be granted to this new class of sportsmen. It is suggested that no novice falconer who has previously failed to raise successfully one of the more common raptors be legally permitted to test his book knowledge of falconry by practicing with the Peregrine Falcon.

5 Bird boxes are now a proven method of encouraging Peregrines to occupy new sites. Man-made structures, which the birds occupy in winter, or on which they may be seen during the breeding season, often lack only a situation in which the falcon can scrape out a nesting hollow. Skyscrapers, church spires, high bridges, and large gas tanks fall into this category. At some of these, an 18 X 18-inch tray containing two inches of dirt and gravel may induce the birds to remain and breed. The extent to which cliffs can be artificially improved by the creation of small caves, the addition of gravel, or the provision against undue rainfall is a matter for thoughtful consideration and future experimentation.

6 The study of future fluctuations of the Peregrine should be encouraged for its conservation as well as its biological value. This report, it is hoped, is a start in that direction. Four things connected with this should be kept in mind by the many persons now interested in this species:

(a) All cliffs that have been thoroughly studied should be accurately mapped, regardless of the presence of Peregrines. Observations from

the base of an escarpment are not conclusive evidence that the birds are absent.

(b) Any publication of the location of an occupied eyrie is a source of potential danger to the subsequent nesting success of the resident birds concerned.

(c) The extensive banding of Peregrines offers the soundest basis for the proper solution of a number of problems. This is one of the few species where the banding of fledgling birds still has definite value.

(d) The annual trapping and banding of adult birds in the general vicinity of their nesting sites is vitally needed as a check on age, fertility, and replacement. This need not be done on nesting ledges and should be conducted near third-class sites only with extreme caution. Data on productivity are still needed for many regions, especially those at the peripheries of *anatum*'s range. In selecting a number of eyries to study, observers are urged to cover only a small number of cliffs and to begin their surveys early in the season.

#### SUMMARY

In this cooperative survey, about 400 nesting sites of the Peregrine Falcon are shown to have been reported east of the Rocky Mountains up to the close of 1940, although several times this number are believed to exist. The birds have declined in numbers by at least 11% in the more settled regions, but a large tree-nesting population apparently disappeared in the Mississippi Valley before it was properly recorded. Breeding distribution and density are found to be affected by (1) the number of cliffs and cut-banks that still afford isolation and proper egg sites, and (2) by territorial competition. Available data indicate a flat type population curve, at least in recent years. Clutches seem to decrease from about four in the United States as one goes north, and the hatching success is shown to be about 75%. The breeding potential may be markedly affected by sterility in females, to some extent in first-year birds, and apparently to a considerable extent in very old individuals. Seasonal nesting losses for nineteen eyries around New York showed a wide variation, and a two-year average of about 1.1 birds fledged per occupied site. The gun is given as the adults' worst enemy, the activities of egg collectors are found to be small in this region, and the operations of falconers not discouraging at this time, although their younger adherents require supervision. Breeding sites are shown to possess different values as ecological magnets—a term used to illustrate how some sites will long outlast others, even though the total population de-

creases. Recommendations for the preservation, management, and future study of these birds are added.

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FURTHER ANALYSIS OF THE SOCIAL BEHAVIOR OF THE  
BLACK-CROWNED NIGHT HERON<sup>1</sup>

BY G. K. NOBLE AND M. WURM

IN a previous study of the social behavior of the Black-crowned Night Heron (*Nycticorax nycticorax hoactli*) two males were found to court for long periods in the presence of unmated females without securing mates. Both of these birds had damaged crowns and plumes and it was inferred that the failure of these birds to secure mates was due to either the one or the other of these defects (Noble, Wurm and Schmidt, 1938). Which factor, if either, was responsible for the failure to breed was of considerable theoretical interest because Lorenz (1937) considers the plumes an "organ of a peace-making ceremony without any sexual meaning." In brief, "it is there strictly as an organ developed in the evolution of the species to control the normal repelling reaction by releasing a greeting reaction which supersedes it" (Lorenz, 1938). In this previous study Noble, Wurm and Schmidt (1938) presented evidence why this conclusion could not be accepted, but they did not have adequate material to determine by experimental procedure whether the plumes, crown, or both were indispensable for breeding.

During the past two years we have had a colony of Black-crowned Night Herons breeding both in outdoor cages and in one of the live-bird rooms of the Museum where our previous studies were conducted. For the use of the latter we are indebted to Dr. Frank M. Chapman. We have attempted by experimental procedure to determine the function of the plumes in the social behavior of the species. The Black-crowned Night Heron develops a rosy tinge to its legs during the breeding season. We have tried to determine by artificially coloring the legs if this color is indispensable to its breeding behavior. Lastly, the rôle of 'releasers' in the feeding behavior of the species was not well understood and we have devised experiments to reveal more clearly the factors involved. The present paper, in brief, supplements our previous study by analyzing the function of the plumes and nuptial leg color of the adults as well as determining the behavior patterns controlling the feeding reactions of the young.

Assistance in colony maintenance was furnished by the personnel of Works Progress Administration, Official Project No. 265-1-97-16 W. P. 10.

<sup>1</sup> Supported by a grant from the National Research Council, Committee for Research in Problems of Sex.

## COMPARISON OF BREEDING BEHAVIOR OF AMERICAN AND EUROPEAN RACES

Unfortunately at the time our previous study was published, Lorenz's 1938 paper on the social behavior of the European race of night herons was not available to us. We were therefore unable to compare in detail our observations on the American form with those made on the European race. Jourdain and Tucker in volume 3 of 'The Handbook of British Birds' (1939), commenting on the breeding behavior of these two forms, state: "Allowing for differences of interpretation, conclusion that a real difference exists in behaviour of the two races seems irresistible." The differences in behavior, however, which these authors stress, seem to us to be chiefly a matter of terminology. Thus, Lorenz (1938) describes well the 'snap-hiss ceremony' of the American form: "With head and wings lowered, he executes a queer sort of courting dance on the spot of the future nest, treading from one foot to the other with a peculiar weaving action. From time to time he suddenly lowers his head and neck vertically, while his shoulders lift as if in a hiccup, and he utters his courting cry. This cry is very deep and quite low, sounding like steam escaping through the safety-valve of a boiler."

Further, Lorenz's 'appeasement ceremony' of the European race, we have identified in our American form as an 'overture and display.' This terminology is preferable to that given by Lorenz because the ceremony is merely the dominance-subordination gestures of young birds to which, in the adult, have been added: (1) a change of voice with concomitant modification of the call; (2) an erection of the plumes, crown-, neck- and chest-feathers; (3) a narrowing of the pupil and protrusion of the eyeball, frequently accompanied by a gaping. The modified 'recognition call' is apparently sexually stimulating to the birds when given with the display and the repeated gesturing, which take place throughout courtship and most of incubation, and serves to form a bond which will hold the pair together.

Lorenz (1938) did not state how he was able to determine the sex of his birds, but concludes: "As it is generally the approaching bird who thus 'greets' first, it is the female who at first seems more intent on this ceremonial, the male answering rather perfunctorily, but soon afterwards it is the other way round. . . . It is always the bird approaching the nest which is most anxious to appease the one that is standing in it. . . ."

We find by a direct examination of the gonads of our colony of the American race that it is the resident male that initiates the ceremony during pair formation to which the female may not even answer.

Later, after the male has become sexually dominant, the female may indicate her subservient attitude by overturing first. The question as to which bird overtures first is important in defining the dominance relation. Lorenz made no attempt to describe this dominance relation in the European race but his description of the pair "getting slowly acquainted" suggests that this race also must work out the same dominance relation as the American form before members of a pair can remain together in a nest territory.

Our evidence for considering the adjustment period an attempt of the male to secure sexual dominance has been fully stated in the earlier paper. Our observations of the last two years merely confirm our earlier conclusions. Details of the behavior of courting European Night Herons during this adjustment period, when sexual dominance is secured, have not been published. At the present moment there is no reason for assuming that the social behavior of the two forms of night heron actually differs in any particular.

#### EXPERIMENTS ON FUNCTIONAL SIGNIFICANCE OF PLUMES AND BLACK CROWN

In 1940, we bred a pair of Black-crowned Night Herons still in the full juvenal dress. These birds, without plumes and with the brown plumage of the immature, laid fertile eggs and hatched young in an outdoor flying cage. A second pair of plumeless herons still in the juvenal dress built a nest together and laid eggs but these did not hatch.

As reported elsewhere (Noble and Wurm, 1940), we were also able to induce chicks only 39 days old to form a pair by injecting them with testosterone propionate. The authors are indebted to Dr. R. MacBrayer of the Ciba Pharmaceutical Products, Inc., for the testosterone propionate (Perandren-Ciba). It is therefore clear that neither plumes nor a black crown are indispensable for pair formation or breeding of this species. Further, an adult female (no. 1241), when exposed to the snap-hiss ceremony of two adult males both of which had the dark crown-feathers cut away, selected the one which also lacked plumes. From such observations and experiments as these it seemed, at first, that the plumes were of no functional significance in the life of the bird. Further observations and experiments revealed, however, an important difference between the behavior of all our birds that lacked plumes and those which had them. A mate of a plumeless heron fails to synchronize its courtship with that of its partner as well as do the controls. When a heron without plumes overtures and displays while stepping toward its mate, the latter will

display nearly as frequently as the controls. But if two mates are standing together and the plumeless bird overtures and displays, this will usually bring little response from its mate. Apparently the plumes emphasize the display, make it more stimulating when given at close range. The result is that pairs containing one plumeless bird are very unstable and tend to break up before egg laying occurs. Detailed observations make it clear that the plumes, instead of being an appeasing organ, as Lorenz assumed, actually form an instrument for enhancing the effect of the display. The repeated display of courtship is not repeated appeasement but a very essential performance for maintaining a bond between the pair.

The plumes appear with considerable irregularity in Black-crowned Night Herons breeding for the first time. In several of our birds they attained a length of from two to three inches at this time. In 1940, we had a flock of 36 herons which we had reared from chicks in the laboratory. When approximately a year old they began to breed in an outdoor flying cage which measured 14 feet by 12 feet by 12 feet. None of these birds had developed plumes. Nevertheless many of them courted and built nests. Male no. 1331 bred with female no. 144 and successfully reared four chicks. Nevertheless the birds stood much more apart than did plumed adults and we did not record a single case of mutual display from the birds when standing together. Female no. 43 was paired first with male no. 1332 and then with an unbanded male, indicating that the bond which held it to the first male was not very strong. It might be argued that this failure to synchronize the display when standing close was merely due to the immaturity of these birds. We therefore devised a series of experiments with adults.

A flock of nineteen night herons in fully adult plumage was maintained in the same indoor flying cage utilized in our 1938 description of normal behavior. This had a floor space of 442 square feet with perches and old nests ranging from three to fifteen feet from the floor. The group consisted of twelve males and seven females which had been sexed by a direct examination of the gonads.

In five males (nos. 203, 241, 1214, 1221 and 1233) the plumes were removed and all the black feathers were plucked from the crown, leaving only a downy covering of short white feathers. In three other males (nos. 1314, 1242, and 242) the plumes were removed but the crown was left intact. In three males (nos. 42, 223, 1313) the plumes were left intact and the crown was plucked. The last male (no. 322) was maintained with the others although plumes and crown were intact. In four females (nos. 1234, 124, 1244 and 1243) both plumes

and black crown were plucked. Another female (no. 1224) had only the plumes removed, while another (no. 1241) had the black crown-feathers, but not the plumes, destroyed. Another female (no. 1321) was maintained with the others although both crown and plumes were left intact.

Our observations on the courtship of these birds have been summarized in tables 1 and 2. We have omitted reference to the twig and snap-hiss ceremonies and have included only the cases of 'overture and display,' for it is only during this ceremony that the plumes are normally erected. The numerical data include only the overtures and displays initiated by the male. For the sake of brevity we designate an overture and display given while the male steps toward his mate as an 'approach courtship,' while a similar overture and display given while both birds are standing near each other and not preceded by any overt movement, we list in the table as a 'close courtship.'

In table 1, we have recorded 223 instances in which plumeless males

TABLE I  
EFFECTIVENESS OF COURTSHIP INITIATED BY PLUMELESS MALES

Bird	Expl'l	Male Courtship				Remarks
		Answered	Not answered	cl.	ap.	
♂ 241	-p bh	0	5	8	3	
♂ 1233	-p bh	1	1	4	5	
♂ 203	-p bh	0	9	0	4	
♂ 1214	-p bh	1	5	22	25	The approach courtships answered only after the female became active in initiating courtships.
♂ 1221	-p bh	1	16	16	38	
♂ 1313	-p bh	1	6	8	25	
♂ 1314	-p n	1	1	5	8	
♂ 1242	-p n	0	0	3	1	
♂ 242	-p n	0	0	0	0	
		5	43	66	109	Never paired; no data.

Mean per cent 'close' courtship answered  $8.3 \pm 2.7$

Mean per cent 'approach' courtship answered  $27.9 \pm 2.8$

cl. = 'close' courtship.

ap. = 'approach' courtship.

-p bh = plumes plucked and crown plucked.

-p n = plumes plucked and crown normal.

were observed to initiate the courtship ceremony. These consisted of 71 'close' and 152 'approach' courtships. In 92 per cent of the close courtships, it was observed that the female mate did not respond with either overture or display to the courting male. There were, however, five exceptions, or 8 per cent of the cases, in which a courting plumless male succeeded in evoking a similar reaction from the mate.

As a control, we have observed four birds with intact plumes (Table 2, Part A). Three of these animals also suffered plucking of the entire black area of the crown. Although only fourteen 'close' courtships were observed, twelve of these, or 86 per cent, were cases in which a male could stimulate its mate to court without approaching from a distance. There were, however, two exceptional cases in which the female did not react to the close courtship of the male even though the latter possessed normal plumes.

Another type of control involved repluming males that had previously been observed while deplumed. The difficulty of this procedure is that artificial plumes cannot be erected and any display of these structures is purely accidental, occurring during movements in which the head is lowered. Furthermore, these plumes become distorted or are lost in a few days. The results (Table 2, Part B) of these attempts can therefore be considered as only suggestive.

4 'close' + 9 'approach' answered; 5 'close' + 2 'approach' not answered.

The same birds while deplumed showed (Table 1):

2 'close' + 2 'approach' answered; 12 'close' + 14 'approach' not answered.

Male no. 1313, which was first observed after (a) the black crown was plucked and normal plumes left intact and then (b) when the plumes were also removed, gave the following results:

(a) 4 'close' + 21 'approach' answered; 1 'close' + 0 'approach' not answered.

(b) 1 'close' + 6 'approach' answered; 8 'close' + 25 'approach' not answered.

From Table 1 it may be concluded that the failure of the female to answer the male's courtship is due to the absence of plumes and not the plucked crown. Males nos. 1314 and 1242, from which only the plumes were removed, showed the same type of behavior as the other males in which both plumes and crown were plucked. Similarly, Table 2, Part A, shows that males nos. 223, 42 and 1313 were usually successful in stimulating their mates to courtship even

TABLE 2  
EFFECTIVENESS OF COURTSHIP INITIATED BY PLUMED MALES

Bird	Expt'l	Male Courtship				Remarks
		Answered		Not answered		
<i>Part A—Control</i>						
♂ 223	n bh	2	0	1	0	
♂ 42	n bh	3	1	0	0	
♂ 1313	n bh	4	21	1	0	
♂ 322	n n	3	3	0	1	
		12	25	2	1	
Mean per cent 'close' courtship answered					86.5 ± 7.1	
Mean per cent 'approach' courtship answered					91.6 ± 5.9	
<i>Part B—Replumed</i>						
♂ 1233	+p bh	3	0	0	0	Plumes artificially replaced.
♂ 1314	+p n	1	9	1	2	Plumes artificially replaced.
♂ 1242	+p n	0	0	4	0	Plumes artificially replaced; distorted soon after bird was released.
		4	9	5	2	

cl. = 'close' courtship.

ap. = 'approach' courtship.

n bh = plumes normal and crown plucked.

n n = plumes normal and crown normal.

+p bh = plumes replaced and crown plucked.

+p n = plumes replaced and crown normal.

though the black crowns alone were damaged. Furthermore, the results of damaging the crown are comparable with those of the completely normal male no. 322.

Although removing the plumes seems to affect chiefly the synchronization of display of two mates when standing together, the absence of plumes also cuts down the effect of a display given while a bird is in motion. In a total of 152 'approach' courtships, 72 per cent of the ceremonies initiated by the plumeless male were not answered by the female (Table 1). Data from control observations (Table 2, Part A), in which the males possessed normal plumes, show that only 8 per cent of the 'approach' ceremonies were not answered.

Our quantitative data, although not extensive, seem to demonstrate that the plumes of the male night heron increase the bird's chance of calling forth a display from his mate following his own performance. Similar experiments with the females' plumes were not as

clear-cut because our number of cases of female courting prior to the male is too small to reveal significant differences. Records of the courtship activity of deplumed female no. 1234 showed that after 29 approaches by the female, male no. 241 was stimulated to courtship only three times. The same female when paired with another male also failed on occasion to stimulate the mate, as indicated by the following observation records:

*June 16.*—Female 1234 joins male 203 which approaches, courting with eyes bulging, breast-feathers fanned, cheeks puffed and overtures. Female 1234 responds with complete overture and display. Birds stand together on U.N.E.N. and bill. Male 203 walks out of nest; female 1234 courts; male 203 walks back into nest without answering and attempts to mount female 1234, which draws to one side and overtures. Male 203 again circles female 1234, mounts, successfully copulates and dismounts; no voice employed.

*June 27.*—Female 1234 approaches male 203 on U.N.E. rung, courting with bulging eyes, breast-feathers fanning and overtures. Male 203 shows no response.

On the other hand, female no. 1234, while initiating the courtship on other occasions, has also been observed to be readily able to induce male no. 203 to court. In every contact between this female and still another male, no. 1214, the latter bird was always observed to react with intense and exaggerated courtship. It appears therefore that, in spite of the absence of plumes in a female, birds of this sex may readily induce a male to respond to their overture and display. Apparently the higher level of androgen in the male sex makes it a more responsive subject to any courtship movements whether or not they are enhanced by plumes. In a previous study (Noble and Wurm, 1940) we found herons treated with male hormone readily display even when confined in small individual cages. Here they were responding merely to some disturbance beyond their cages, sometimes even to the approach of the observer.

Observations of the above plumeless adult birds have revealed additional unique effects of depluming. A frequent observation, typical of every pair, was that the female perched outside of, and at some distance from the nest. A detailed observation of particular pairs revealed that it was the lack of a stimulating performance that prevented their standing together.

*June 2.*—Male 1221 on nest comes up on rung and courts completely. Female 1241 fails to respond and jumps down to nest. Male 1221 comes down to nest and again courts. Female 1241 again does not answer and walks out of nest on left diagonal bar.

*June 5.*—Female 1234, mate of male 241, is perched on upper rung above C nest. Female 1234 spends much time away from male 241 and is usually perched on window sill or rung. When disturbance occurs, female 1234 joins mate, issuing loud high-pitched guttural voice, and is always answered by male 241, standing on M.N.W.N. rung.

*June 6.*—Male 241 lifts leg to back of female 1234 and issues low-pitched, guttural voice, breast-feathers fanned, eyes bulging, while bird overtures. Female 1234 responds with high-pitched guttural voice and immediately flies down to window sill.

*June 14.*—As male 1214 snap-hisses, female 1234 looks up from floor, flies to window sill. Male 1214 snap-hisses again and again; female 1234 finally flies back to nest rung. Male 1214 courts but female 1234 shows no response.

*June 15.*—Male 1214 courts female 1234 which shows no response; overtures and displays again, crowding female 1234, who flies down to window sill.

These males, nos. 1221, 1214 and 241, were without plumes during the above observations; female no. 1234 also had none, while female no. 1241 possessed them. The females showed a marked tendency to desert their mates, especially when the latter courted at close range. This behavior stood in contrast to that of females with plumed controls. These tended to retain their positions (Noble, Wurm and Schmidt, 1938, Plate 4).

Normally a pair forms when the female is attracted to a snap-hissing male. During the early stages of courtship this bond is strengthened by 'approach' and later by 'close' courtships. Since depluming weakens the stimulating effect of the display, it would be expected that deplumed pairs would not remain together and the above observations confirm this assumption. Normally only an un-mated, sexually active male is observed to produce the snap-hiss. This call ceases soon after a female enters a male's territory and can be made to reappear by removing the female from the cage. We have found that although deplumed herons may actually pair, that is, occupy a common area, show no aggression toward each other, overture and display to one another, the male frequently continues to snap-hiss for a long time after the female arrives. This again is evidence that the lack of plumes has produced some deficiency in the behavior of the female to which the male responds by continuing his snap-hiss ceremony.

The presence of eggs in the nest may be considered a factor which tends to counteract the deficiency and to keep the pair together until

the young have been raised. For example, it was observed that female no. 1234 had successively paired with and had copulated with males nos. 241, 1214, 203 and 1221. All these males had been without plumes and it might be expected that this female would eventually desert male no. 1221 as she had deserted the other males. However, it was found that this pair continued to remain together after the eggs were laid. The presence of eggs in the nest seemed, in brief, the chief factor holding the pair together. This was also shown by the behavior of female no. 1241, male no. 1221 and male no. 1313, which may be given in some detail.

Pair formation first occurred between the female and male no. 1221, although both males had been snap-hissing and evidencing sexual stimulation for some time. It was at once clear that the presence or absence of plumes was not essential for pair formation to take place, because male no. 1221 had neither plumes nor crown, while male no. 1313, the rejected suitor, had at this time normal plumes although a plucked crown. After pair formation, 'close' courtships never resulted in synchronous behavior in the pair, male no. 1221 and female no. 1241. The female perched on the rung above the nest away from the male or completely outside the nesting area. At this time the female began to respond to the snap-hissing of male no. 1313. Copulation and mutual 'close' courtships were then observed in this pair. Male no. 1313 was then deplumed. It was at once observed that the female now failed to respond to 'close' courtships of the male. She soon deserted the area and perched away from the nest. The male now began to snap-hiss even when standing close to the female. The female alternated between the center nest, that of male no. 1313, and the upper southwest nest, that of male no. 1221. Her vacillating between these two males seemed due to the attraction of snap-hissing of one male and the repulsion of the 'close' courtship of the other. Eggs were first laid in the nest of male no. 1313 and the female was now observed to remain usually in this nest area, while the male spent most of the time incubating during the day. However, the female would make occasional excursions to the nest of male no. 1221, loosen twigs from the platform and carry them to the incubating male of the other nest. During these contacts with male no. 1221, there occurred overtures with very little display. After the third egg was deposited in the center nest six days later, the clutch was transferred to the upper southwest nest, that of male no. 1221. During the remainder of that day, the female stood beside male no. 1313 while the latter brooded an empty nest. During the two succeeding days female no. 1241 trans-

ferred her interest to male no. 1221. Another egg was added by the experimenter to the clutch and both male no. 1221 and female no. 1241 began to take turns at incubation.

It should be emphasized that these birds were breeding in the same room that they occupied during our previous (1938) study. At that time there had been no shifts of mates and very few failures to respond to the 'close' courtships of mates. The conclusion seemed obvious that the depluming had seriously interfered with the constancy of the nuptial bonds formed by our experimental birds.

#### MALE BEHAVIOR BY THE ADULT FEMALE

Although the overtur and display of the night heron are mutual, they are not identical in the two sexes, for either one or the other sex holds its head higher at different stages in the ceremony. We have frequently noted that when birds attempt to display with heads at the same level, a maladjustment is indicated, and the birds fence with upraised bills until one gives way or assumes a subservient position of the head. Verwey (1930) saw similar maladjustment of behavior in the European Grey Heron, *Ardea cinerea*, but he interpreted it in terms of one bird fearing the movements of the other and threatening until mutual confidence was established. In the night heron the maladjustment occurs at the time the male, having attracted a female by snap-hissing, overtures and displays, endeavors to become sexually dominant by a series of billing bouts with head in a high position. The Grey Heron also displays with neck elongated vertically but the neck-feathers are not raised in the manner of the night heron. Nevertheless the similarity of movement strongly suggests that its function is primarily to secure sexual dominance as in the night heron.

During the last three years we have frequently bred the night heron under ideal conditions for observation. Although the dominance relations of male and female change during the display, we never saw a female go further and develop any of the other ceremonies characteristic of the male except in one case. This bird, female no. 1224, twice performed the snap-hiss ceremony, on May 22 and again on May 24, 1939. It also showed a typical male twig ceremony twice. In the manner of sexually active males inviting pair formation, it defended its territory weakly against other birds, regardless of sex. Eventually it paired with male no. 1314 in a typical manner and laid three eggs.

We have shown elsewhere (Noble and Wurm, 1940) that the female Black-crowned Night Heron normally produces considerable amounts

of androgen. In fact, her interest in nesting material may be attributed to a male hormone, as also her modified voice and her display. Females which received large amounts of the androgen, testosterone propionate, developed a typical snap-hiss and twig ceremony. We may therefore assume that this bird, female no. 1224, was one in which its own ovary was producing more androgen than that of the typical female.

#### SIGNIFICANCE OF NUPTIAL LEG COLORING

The Black-crowned Night Heron usually develops pinkish legs in both sexes during the breeding season. Noble, Wurm and Schmidt (1938) remarked "that the tendency for males to attain the full color more often than the female is correlated with the greater use the male makes of his legs during courtship. During the snap-hiss ceremony the limbs are rhythmically lifted and extended as if to catch the eye of a female." We have shown above that while the plumes were stimulating organs they were not indispensable to a successful mating. The question remained if the reddish leg color was an indispensable 'releaser' to female behavior.

In order to test this question we have painted out the red color by covering the legs of breeding birds with a blue-green lacquer. Two mated males, nos. 222 and 303, as well as four unmated but sexually active males, nos. 133, 304, 32 and 341, were treated in this way. In no case could we detect any influence of this change of leg color on the courtship behavior of the birds. The four unpaired males secured mates as rapidly as did the controls.

Further, pinkish legs are not a prerequisite for a female to secure a mate. Occasionally young birds during their first breeding season do not attain the typical color and yet breed successfully. Such a bird was female no. 1321 that paired with male no. 1233. A male when snap-hissing may attract females with either pink or buff-colored legs but, according to our observations, shows no preference for the rosy-legged birds. Thus male no. 1313 was observed in its reactions to females no. 124 and no. 1222, which had buff legs, and females no. 1241 and no. 1224, which had red legs, on several days during May and June. The male snap-hissed to any female that came near him regardless of the color of the visitor's legs. Further, the peck-hiss ceremony, which Noble, Wurm and Schmidt (1938) considered a modification of the snap-hiss, was given by this male to female no. 1241 at the same time that another male, no. 1221, gave a snap-hiss in her direction. This failure of males to discriminate between rosy- and buff-legged females did not, however, seem very

surprising for, as stated above, we had observed males isolated in separate cages give a typical snap-hiss when injected with an androgen.

#### RELATION OF PARENTS TO YOUNG

Although we have reared night herons for three years in both outdoor and indoor cages and have watched both groups from blinds, it is surprising how difficult it has been to see the beginning of feeding behavior. This is probably because the parents treat the young at first very much in the manner of eggs. Both feet and beak are frequently pressed against the eggs as the parent with rapid lateral movements of the body settles down to incubate them, and the same movements of feet, bill and body occur when settling on the young to brood. These contacts cause the young to give their food cry or cackle, which may be written as *kak-kak-kak*. This monotonous and persistent cry is given with an irregular waving of the head. Both sound and movement are apparently stimulating to the parent for the latter eventually draws in its bill, rests the point on the bottom of the nest and regurgitates some partly digested food. This is then held in place between the mandibles while the young birds peck at it, often for a minute or more, before the parent swallows the food again.

The resemblance of the movements used in stimulating the young to those of egg rolling raised the question if there was any real break in the pattern of parental behavior at the time of hatching other than the newly acquired feeding reaction. We tested this question by giving three pairs of adults, which had been incubating their own eggs for approximately a week, sterile eggs in place of their own. Although the normal incubation period in our laboratory cages is 22 to 24 days, these birds continued the incubation approximately twice as long. One pair incubated 51 days, the second 40 days and the third 49 days. It seemed that in the absence of the young's food cry the parent would continue its care of the eggs in the usual way for at least twice the normal period of incubation.

The voice of the young changes with age. During the first two weeks it has a shrill, metallic quality and then gradually becomes harsher. By the third week the aimless swinging of the head from side to side of the young chick is replaced by a sharp, upward angulation of the head while giving the food cry. The chick learns to distinguish its parents from its brothers and sisters and directs its food begging toward the former, as illustrated in the following case. A chick standing outside the nest was stimulated to call for food at the time another young in the nest was doing likewise. The former

then proceeded in the direction of the parent, also standing just outside the nest, and grasped the adult's beak, soliciting food. It is at this stage that the parent returning to the nest gives an overture and recognition call, not at its mate but directly at the young. Some adults have not at this stage lost the guttural quality to their voice and it would seem that they were courting their young. Lorenz (1938) describes the European race as having less knowledge of parents than our birds displayed. He states: "The young birds do not seem to recognize their parents, or else their begging reactions are released on seeing any adult, so that they will most obtrusively molest every old bird they meet, crowding against him and trying to seize his bill. Such impudent youngsters are not only absolutely immune from attack, but the old birds actually seem afraid of them and will retreat whenever they see one coming."

Our young night herons showed very little tendency to wander from the nest during the first month. When three weeks old they would defend their nests against adults not their parents. This is considerably earlier than Noble, Wurm and Schmidt (1938) reported, and there is doubtless considerable variation in this regard. One group of approximately this age attacked a mounted pheasant placed two feet from the edge of the nest. The overturing with recognition cry of the adult approaching the nest apparently helps the young to recognize their parent, although the vigor with which they seize the bill simulates an attack. Although we have witnessed the feeding many times, we have never seen a young night heron solicit food by seizing the beak of any adult other than its own parent.

Gross (1923) describes the feeding of the young under natural conditions very briefly: "In delivering food to the downy young the adult seemed to insert the tip of her beak into the wide open mouth. . . ." We have never seen such behavior in any of our birds and doubt if it occurs in nature. Herrick (1935), in classifying the methods of feeding young birds, states that regurgitation is "characteristic of albatrosses, herons, egrets, and flamingoes, which enlists active coöperation of both adult and nestling; but the transfer of regurgitated food is effected indirectly by a crossing or juxtaposition of bills, rather than by insertion of the parent's bill in a young one's mouth or *vice versa*." We have often seen the young night heron seize the parent's bill nearly at right angles and assume this is the typical method of receiving regurgitated food from the parent.

It is remarkable that although chicks are eager for food held between the mandibles of the parents, they pay not the slightest attention to it when thrown into the nest by the experimenter. We exper-

imented with seven different nests and sixteen times attempted to feed chicks over a week old by placing food in the nest. In no case did we succeed. If chicks the same age are taken from their parents and force-fed for several days, they may be taught to take food from the hand. Some older chicks will take it spontaneously from the hand. But normally only food delivered by the parent appears to be identified as food. Occasionally the food regurgitated by the parent falls into the nest. Under these circumstances it is eagerly picked up and devoured by the young. Hence, it is not the location of the food but the way it is presented that stimulates its acceptance.

Chicks at leaving the nest soon take food from the common feeding area. Our youngest chick observed to take food independently of the parent was 37 days old. Other chicks in the same cage were taking food from the parents at 90 days of age. Under laboratory conditions there is a considerable range of variation in the age at which freedom from parental care takes place.

One of the most surprising reactions observed in our young night herons occurred in a group three to four weeks of age. These had been collected in the field when apparently ten to fourteen days old and had been isolated since their arrival from our breeding adults. We changed the voice of one of these young birds by treatment with testosterone propionate and it began to overture and display like a typical breeding adult. When this bird approached one of the untreated young the latter gave a typical food begging with characteristic cry, waving head and slightly raised wings. Because none of these birds had given the infantile food cry since reaching our laboratory, we assumed that the guttural cry of a sexually displaying bird would automatically release food begging in any young bird that was not too inhibited by strange surroundings. We repeated this experiment with many young birds and found that not only the food begging could be elicited but also the 'intimidation call.' That is, the young birds when responding would also spread their wings and give a characteristic note (Noble, Wurm and Schmidt, 1938) as if to protect the imaginary food. This behavior was surprising in that only the voice of the sexually stimulated chick called it forth. Nevertheless, we could not be certain that the reaction was actually innate. We did not know the history of the particular birds which responded. It was possible they had learned to associate the guttural sex voice with that of the parent returning to the nest. The overture and display with guttural voice are characteristic of nest relief and it would be indeed surprising if the chicks had not heard the sound many times while in the parental nest.

The plumes usually are erected when the approaching parent overtures and calls in response to the aggressive behavior of the young. Nevertheless, plumes are not indispensable for normal behavior of the young. Male no. 1331, from which the plumes were absent, was seen to overture to its young with the result that they quieted down at once. He also regularly fed them without difficulty. The young appear to recognize their parent's voice, but this may be due to the fact that only resident adults call when approaching the nest. If they mistake the parent for a stranger, they shift from an attack to food begging when the parent calls.

Our interest in the induced food call was greatly increased when we discovered that at the close of any breeding season fully adult birds, if they lost their nuptial colors of lores and legs before their mates, would frequently give the infantile food cry. In no case did we observe that these adults, which had suddenly developed the childish ways, were ever fed by their mates. Either sex could play the food-begging rôle if it lost its nuptial color first. In pair male no. 303 and female no. 1414, it was the female that begged. In pair male no. 1133 and female no. 1222, the male lost his sexual pigmentation on August 28 while the female continued to show both a black lore and a guttural voice. Subsequent to this date the male, instead of remaining passive to the gestures of his still sexually active partner, responded with infantile food begging whenever the female approached the nest and called. Both adults of pair male no. 431 and female no. 441 had lost their nuptial colors by September 3, but by September 5 the male showed a recrudescence of the dark lore color and the female began to beg food. In only one case where there was a recovery of lore pigmentation did a pigmented female give a food-begging call. She responded to a pigmented female which with an uncolored male had formed a trio. In every case where we could trace the first appearance of a begging call, it was found to be given in response to a guttural sex call by a bird which was out of season or nearly so.

This discovery, that a sex call can release food begging in a fully adult bird that had not called in this way for a year or more, seems of considerable theoretical interest. In many birds it is the female which begs for food from her sex partner. This serves as a bond between the pair and also helps the male to secure sexual dominance (Noble and Wurm, in press). Normally in the night heron, both sexes develop guttural voices during the breeding season and hence neither sex adopts a food-begging ceremony. The night heron has developed a method for securing sexual dominance which is totally

different from those birds that normally practice food begging at the beginning of the breeding cycle.

Although the sexually modified voice seems to awaken the begging response in adult herons and possibly in the juvenile bird as well, young night herons beg for food not at first in response to voice but to tactile stimulations and they continue to beg frequently after the parents have lost their nuptial colors and guttural voice. Thus a chick of male no. 1123 and female no. 1212 did not desert the nest until 115 days old. By this time both parents had lost the breeding colors and sex voice but the chick continued to give the food cry whenever the parents approached and was fed regularly by them. The out-of-season adults that begged from their in-season mates never received food from them in our presence but they nevertheless continued their calling for two or three months after their mates had lost their nuptial colors. Two young herons, which we frequently petted and fed by hand, continued to give the juvenile food call until they were two and a half years old. One had made some attempt to breed, for it paired and built a nest in the meantime, but when an observer approached it would almost invariably sway its head, partially raise its wings and give the characteristic food cry. During adult life these herons were very rarely fed by hand yet nevertheless their response to a human observer remained the same. Presumably these herons had early learned to associate being fed with the presence of a human observer. Since lack of hand-feeding did not decondition them, we may assume that they secured a certain satisfaction from being petted.

#### DISCUSSION

It has frequently been pointed out that birds and other animals may react innately to particular sounds. When a female night heron, breeding for the first time, comes slowly into the territory of a snap-hissing male, we have every reason to assume that the bird is innately attracted by this particular cry. Similarly, when a parent night heron with its first set of chicks lowers its head and regurgitates in response to their persistent food cry, it would seem that the sound induced a response in the parent. Unfortunately, the stimulative value of the rhythmical leg movements in the case of the snap-hissing male or of the head-waving in the instance of the food-begging chicks is not known. Lorenz (1935) assumes in regard to the plumes, "that the seeing of the form is of far less importance than the seeing of the movements, particularly in mentally inferior birds" (translation). This would seem to apply to the majority of the 'releasers'

discussed by Lorenz. They are merely adornments developed to emphasize movements. Our work with deplumed night herons, discussed above, indicates that the plumes do have a stimulative value during courtship but, since coition can occur without them, they are not indispensable to breeding. The plumes merely enhance movements which are necessary for the continuation of the bond between the pair. A somewhat similar condition was found in the jewel-fish, where both sexes don a red dress during the breeding season, and this was shown by Noble and Curtis (1939) not to be necessary for breeding but it helped in the formation of pairs.

Female night herons are attracted by the snap-hiss ceremony of the males but they do not remain with them unless they are adequately stimulated by the overture and display. The plumes play no rôle in the initial approach, but they seem to have a very definite part in holding the pair together and synchronizing the mating. There is no sexual selection in the sense of initial female choice, but a very definite one of female persistence in her original quest. Marshall (1936) concludes, in regard to the effect of mutual courtship, "it is not the female which selects the male; it is the pair which have the highest capacity for mutual stimulation which are, so to speak, selected by Nature for the perpetuation of the race." He considers mutual selection a special case of natural selection and not one of sexual selection at all. If, however, as in the case of the night heron, we consider the behavior of the female in detail, we find that the female after her original approach to an ornamentless male actually goes in search of a more stimulating mate. The plumes may not attract but they tend to bind, and as such are epigamic characters of an accessory type (Huxley, 1921). We may, therefore, speak of mutual courtship in the night heron at least as a special case of sexual selection with considerable justification.

It might be argued that the night herons in our experiments, being very familiar with the normal appearance of their kind, were merely frightened at the unusual appearance of plumeless birds. To our eyes the crownless birds were even more bizarre than the plumeless ones and yet they seemed as successful as intact birds in holding their mates. It is not the combination of white plumes against a dark background, but the plumes themselves which seem to be stimulating. Unfortunately, it was not possible to eliminate voice in these experiments. But, to judge from the previous work of Noble, Wurm and Schmidt (1938) on the reactions of young birds with plugged ears, voice would seem to play as important a rôle as motion.

Although we secured no deviation from the normal pattern of be-

havior by coloring the legs of night herons before or after pair formation, it does not follow that this nuptial color is not stimulating to the birds. Under the conditions of our laboratory the color, when modified, was not stimulating enough to produce any deviation in behavior. Apparently the red legs, like the plumes, accentuate the movements and these, if visible, are the stimulating devices. It would be interesting to know if coloring the plumes black would have any effect on the retention of mates. To judge from our experiments with the legs, if the light was sufficient, the color would be immaterial. Night herons are often active at dusk and it is possible that light color of the plumes renders them conspicuous under these conditions.

In general it may be said that the nuptial adornment of the night heron serves to emphasize movements of particular types and it is these that are stimulating rather than the adornments *per se*.

#### CONCLUSIONS

1. The European and American races of Black-crowned Night Heron (*Nycticorax n. nycticorax* and *N. n. hoactli*) have apparently the same courtship pattern, discrepancies in the published accounts being due either to different terminology or to lack of information.
2. The plumes of the male heron serve to emphasize the overture and display ceremony which aids the formation of nuptial bonds. Removal of the plumes weakens the bonds, the pairs tend to disintegrate, the birds stand apart or seek new mates and the male tends to continue his snap-hiss ceremony, unlike a typically paired bird.
3. The difference between the number of responses given by a female to the overture and display ceremony of the male, given when the birds are standing together, is significantly less than the responses given by females under the same conditions to plumed males.
4. The plumes of the female have less functional significance than those of the male apparently because the breeding male is more reactive to, and requires fewer specific, external stimuli.
5. The crown-feathers of either sex may be removed without affecting the synchronization of courtship or weakening the nuptial bonds.
6. The rosy leg color of the breeding night heron serves to emphasize the leg movements of the snap-hiss ceremony. Coloring the legs blue-green has no effect on the speed of pair formation or the duration of the bond.
7. The snap-hiss ceremony is characteristic of the male. A single case was observed of a female which developed this ceremony. It

did not prevent her from mating and eventually showing normal female behavior.

8. The guttural sexual voice of the night heron, even when induced experimentally in chicks with testosterone propionate, may call forth food-begging behavior in untreated chicks. Among pairs of adults, the bird that loses its nuptial color and voice first may respond to the other's sexual voice by food-begging behavior.

9. Night herons, which have been trained as chicks to respond to the observer with food begging, retain the habit for over two years, although rarely fed by hand.

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## ARTERIES IN THE HEART REGION OF THE KIWI

BY FRED H. GLENNY

## INTRODUCTION

THROUGH the cooperation of the Curator of Birds of the United States National Museum, the writer was able to study the arrangement of the main arteries in the region of the heart of the Kiwi (*Apteryx australis mantelli*). The findings are set forth in the following observations with the hope that they may be of interest to students of bird anatomy, and to give a better understanding of the structure of the bird.

## OBSERVATIONS

The left and right innominate arteries arise from the aortic root of the right ventricle. The systemic arch on the right side remains as the functional arch and joins the right radix aorta which passes posteriorly to join the definitive dorsal aorta. The left and right ligamentum botalli are present along with the distal portion of the left radix aorta now fused with the left ligamentum aortae (Glenny, 1941).

Unlike most other birds (Glenny, 1940, 1940a, 1941a), the innominate arteries give rise to two thyroid arteries (dorsal and ventral) before giving rise to the internal carotid and subclavian arteries. The subclavian arteries give rise to the 1) coracoid, 2) internal mammary or intercostal, 3) cutaneous, and 4) two pectoral-axillary arteries.

With the reduction of wings from flight, there is considerable modification in the areas supplied by the pectoral and axillary arteries as compared with those areas supplied by the same vessels in other birds. Thus the arteries which normally supply the pectoral muscles of other birds, supply the wings, skin, and pectoral muscles in the Kiwi. The latter or pectoral muscles are supplied by small branches of the larger arteries which supply the wings. The cutaneous artery supplies the skin and is lateral in position.

The left carotid arch gives rise to the 1) brachio-scapular, 2) internal carotid, and 3) superficial cervical arteries. The left superficial cervical artery gives off a branch which passes laterally along the neck and supplies the muscles and other tissues in that region, while the other branch supplies the trachea and lymphatic glands on the left side of the neck. The internal carotid enters the hypapophysial canal and passes anteriorly toward the head alone.

The right carotid arch gives rise to the 1) cervico-brachio-scapular and 2) ascending-oesophageal arteries. The former sends off small branches to the syrinx, brachio-plexus, shoulder and scapula, and anteriorly along the dorsal region to the cervical musculature. The ascending-oesophageal gives rise to one important branch which supplies the lymphatic glands on the right side of the neck; otherwise it supplies the oesophagus and to a lesser extent other tissues in this area.

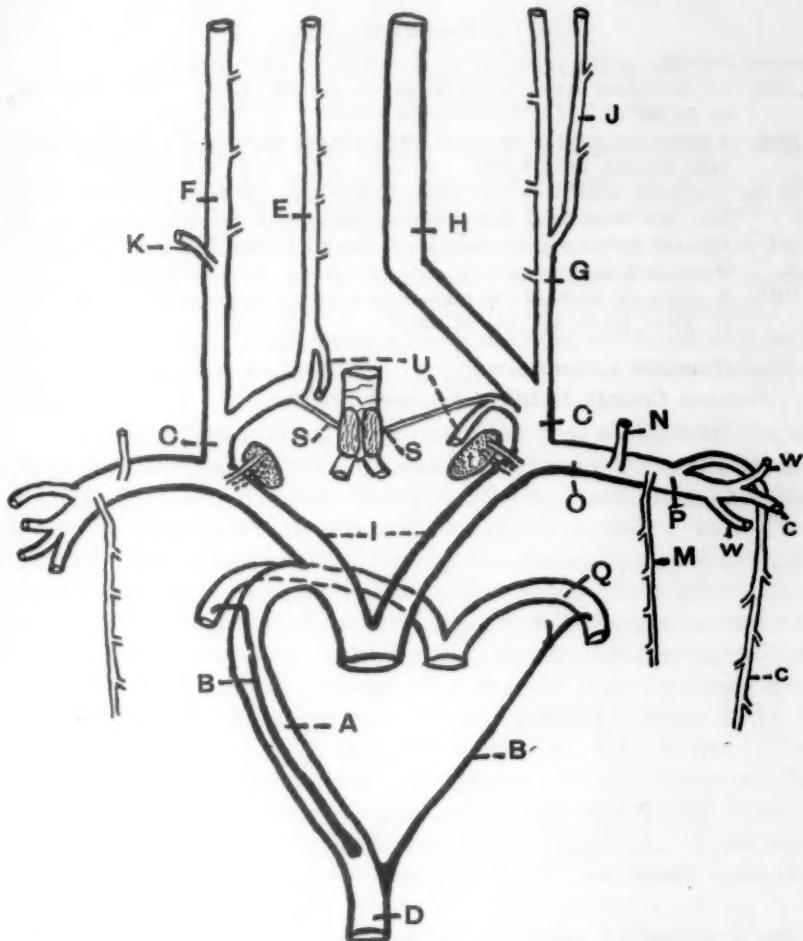
#### DISCUSSION

Although only one specimen of this species of Kiwi was available, based upon the former experiences of the writer it is safe to assume that the above picture is a reasonable representation of the condition of the anterior part of the arterial system in *Apteryx*.

The writer is of the opinion that this condition is to be considered as an example of modification rather than of extreme primitiveness. This conclusion is based upon the evidences presented in the penguins, a late rhea embryo, and other presumably primitive birds. The fact that a branch of the right carotid arch is superficial is an indication that this arrangement is one of modification and perhaps to a lesser degree of primitiveness. However, the greatest modification of

TEXT-FIG. 1.—Diagrammatic representation of the main arteries in the region of the heart of the Kiwi (*Apteryx australis mantelli*).

- A, right radix aorta.
- B, ligamentum aortae.
- C, internal carotid artery.
- D, dorsal aorta.
- E, right cervico-brachio-scapular artery.
- F, right ascending oesophageal artery.
- G, left ascending tracheo-lymphatic artery.
- H, left vertebral artery.
- I, innominate arteries.
- J, superficial cervical artery.
- K, right lymphatic artery.
- M, internal mammary (intercostal) artery.
- N, coracoid artery.
- O, subclavian artery.
- P, pectoral arteries.
- Q, pulmonary artery.
- S, ductus shawii.
- U, scapular arteries.
- c, cutaneous branches of pectoral artery.
- w, axillary branches of pectoral artery.
- t, thyroid gland and arteries.



Diagrammatic representation of the main arteries in the region of the heart of the Kiwi (*Apteryx australis mantelli*).

arterial supply is found in the arteries which are derived from the subclavian artery. In the rhea and penguins, these arteries follow much the same general pattern as those in other species of the more primitive orders of birds.

#### ACKNOWLEDGMENTS

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BREEDING WOODCOCK POPULATIONS<sup>1</sup>

BY ALLAN T. STUDHOLME AND RUSSELL T. NORRIS

DURING the spring of 1939 a fairly heavy concentration of breeding American Woodcocks (*Philohela minor*) was observed in the scrub-oak and pitch-pine forest type of central Pennsylvania. This type constitutes about one-sixth of the forest area of the State, and the area in Centre County, known locally as the 'Barrens,' is quite similar to this type in other parts of the State. Cutting operations and repeated burning have produced dense growths of scrub oak and pitch pine that usually support high populations of various species of wild life.

In Centre County the part of this forest type utilized by singing woodcocks is covered by a low growth of scrub oaks (*Quercus prinoides* and *Q. ilicifolia*), panicled dogwood (*Cornus paniculata*), hazelnut (*Corylus americana*), prairie willow (*Salix humilis*), sweet fern (*Myrica asplenifolia*), and blueberries (*Vaccinium* spp.). The larger trees scattered throughout the area are mostly pitch pine (*Pinus rigida*), black cherry (*Prunus serotina*), aspens (*Populus tremuloides* and *P. grandidentata*), and shadbushes (*Amelanchier canadensis* and *A. oblongifolia*). Small openings that serve as singing grounds occur over most of the lower regions. These openings average 21 by 37 feet; the largest is 47 by 54 feet and the smallest, 5 by 12 feet. They are covered with wild-oat grass (*Danthonia spicata*), bluegrass (*Poa pratensis*), and numerous scrub-oak and panicled-dogwood stems, 6 to 12 inches high (Norris, Beule, and Studholme, 1940). These open areas are usually level and are surrounded by dense woody vegetation from two to four feet high.

Because this area was an unusual type of cover for breeding woodcocks, a population-density study was carried on during 1939 and 1940 to determine the importance of this forest type as woodcock cover in Pennsylvania. In addition, many interesting facts concerning the breeding habits of these birds were learned, and a technique by which the singing males could be trapped on the singing grounds was developed (Norris, Beule, and Studholme, 1940). This work was carried on under the supervision of Dr. Logan J. Bennett, Fish and Wildlife Service, U. S. Department of the Interior; Dr. P. F. English,

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Department of Zoology and Entomology, The Pennsylvania State College; and Dr. W. C. Bramble, Department of Forestry, The Pennsylvania State College.

In 1939, woodcocks were first heard in the Barrens near State College on March 26, and a few were flushed as early as March 16. The winter of 1939 was normal, however, and very little snow covered the ground during March. Discovery of the breeding concentration of these birds in the scrub oak and pitch pine forest type was accidental, and the writers believed that the birds had been singing for several days before the first record. Undoubtedly they arrived in Centre County during the early part of March in 1939.

The winter of 1939-40 was severe throughout eastern United States, but it was most injurious in the South. The Gulf States experienced one of the worst winters in history: temperatures were extremely low, and snow fell in many places for the first time in years. The severe weather throughout the main woodcock winter range was reported to have caused heavy mortality among the birds. Reports from Louisiana (McIlhenny, 1940) regarding woodcock suffering from cold during January caused much concern among game administrators, sportsmen, and ornithologists. Large numbers of birds were reported to have been found in emaciated condition on the feeding grounds of Louisiana, and early in the year it appeared that the woodcock population would experience a tremendous decrease. Because of these reports, the arrival of woodcocks in Pennsylvania was anxiously awaited and a close watch was kept on all likely woodcock coverts in the vicinity of State College.

The late winter in central Pennsylvania was also severe, however, and this undoubtedly caused a retardation of the spring woodcock flight. On February 13, the State experienced a heavy snowfall, about 18 inches falling in Centre County. This snow, together with several subsequent snowfalls, remained on the ground until the 1st of April and even later in some wooded regions. Dick Rauch (Langenbach, 1940) observed singing woodcocks in Harrisburg (only ninety miles southeast of State College) on March 7. There is, however, a great difference in the climate of these districts. At that time most of the snow had disappeared in the vicinity of Harrisburg, while about sixteen inches of snow still remained in the woods in Centre County.

Singing woodcocks were heard in Stone Valley, Huntingdon County, near Charter Oak (about nine miles south of State College) on March 29, 1940. On this date twelve birds were heard singing during the evening flight period. On the morning of March 30 the Barrens area (where the 1939 study was carried on) was searched and only

two birds were heard singing. These two areas were watched carefully, morning and evening, but no singing grounds were finally occupied by woodcocks until the 7th of April. Most of the birds seemed to move from one location to another, and territories were not definitely established until the second week in April. The writers believe that much of this movement and fluctuation may have been due to migrant birds.

The Stone Valley area resembles more closely the typical Pennsylvania woodcock breeding coverts. A small stream bordered by a mixed growth of hemlock and hardwoods runs through the valley. There are many dense stands of alder, and much of the land is wet. The principal tree species in the bottomlands bordering the stream are hemlock (*Tsuga canadensis*), beech (*Fagus grandifolia*), red maple (*Acer rubrum*), tulip poplar (*Liriodendron tulipifera*), black birch (*Betula lenta*), yellow birch (*Betula lutea*), white ash (*Fraxinus americana*), large-toothed aspen (*Populus grandidentata*), alder (*Alnus incana*), blue beech (*Carpinus caroliniana*), flowering dogwood (*Cornus florida*), hop hornbeam (*Ostrya virginiana*), and shadbush (*Amelanchier canadensis*). Virginia pine (*Pinus virginiana*), pitch pine (*Pinus rigida*), and table-mountain pine (*Pinus pungens*) are scattered throughout the old fields that lie on one side of these bottomland hardwoods. On the other side the lowland area is bordered by a series of ridges, on which the mixed oak-hickory forest type occurs.

Woodcocks utilized the old fields near the stream as singing grounds, and a few of the male birds selected openings in the wooded areas. The singing grounds were generally much larger than those of the Barrens area, and the woodcocks sang from one opening, not from two or more as was the case in the pitch pine and scrub oak type.

No intensive study was carried on in Stone Valley in 1939 or 1940, and no population figures are available for that area. That section supported a good population of breeding woodcocks in 1940, however, and coverts of that type undoubtedly produced many woodcocks throughout the State.

After the woodcocks had established their singing territories and all fluctuations in their numbers had ceased, a 1940 singing-ground census was carried on in the Barrens area. In 1939, this tract supported 45 singing males on the 950-acre study area. Twenty-seven singing males were counted in 1940, representing a 40 per cent decrease from the 1939 population. This fluctuation in singing males from 1939 to 1940, however, is known to have occurred only in this area. There is a possibility that the 1939 population was abnormally

high in this forest type. Also, numerous reports indicate that some breeding birds were present in all suitable environments throughout Pennsylvania in 1940.

It was hoped that the 1940 study might yield some information on the question of singing males returning to the same singing grounds used by them during the previous year. Sixteen of the twenty-seven singing males in the Barrens area in 1940 were utilizing almost exactly the same openings that woodcocks used in 1939. Seven of the 1940 male woodcocks were singing within fifty yards of 1939 singing grounds, and the remaining four birds occupied new singing territories.

In an attempt to determine if male birds returned to the same singing grounds from year to year, live-trapping operations were continued during the spring of 1940. The woodcock trap used in the spring of 1940 was patterned after the 1939 model (Norris, Beule, and Studholme, 1940), but a No. 4 jump-trap was used instead of the No. 3 trap and the gill netting was replaced by Gold Medal seine ( $\frac{3}{8}$ -inch mesh). This new trap was faster, and the trapped birds did not entangle themselves in the netting. Early in the season two woodcocks got out of the revised traps because the jaws closed so rapidly that they sprang open and allowed the birds to escape, but this defect was easily remedied by shortening one of the wires enough to allow it to fit inside the other. No birds escaped after this change was made, and twice woodcocks standing beside the decoy were trapped.

From April 4 to May 12, ten male woodcocks were caught in this trap on their singing grounds. Two were trapped in the Stone Valley area, and eight were trapped on the Barrens tract. Three of these birds were taken on the same singing grounds where birds were banded in 1939, and another was caught seventy yards from a singing ground where a bird had been trapped in 1939. None of these birds had bands when they were trapped. In addition, two woodcocks without bands were observed with a strong spotlight and field-glasses on singing grounds where birds were trapped in 1939. Although none of the ten birds caught had previously been banded, a banded woodcock was observed singing from an opening on which no bird was trapped in 1939. Several attempts to trap this bird were unsuccessful, and it disappeared about May 1, long before the singing season was over.

In 1939, each male woodcock in the Barrens area usually sang from one or two openings within his singing territory, but in 1940 the birds were not so consistent. Instead, they generally sang from several openings within their territories and did not limit their flight

songs to one or two openings. This movement made it exceptionally difficult to catch the birds, as the traps were often misplaced. Attempts to call the woodcocks by 'peenting' met with little success as compared with that of 1939: only two birds were lured to the decoy in this manner during 1940. Perhaps the less dense population in 1940 gave the singing birds more space for selective movement over singing-ground areas.

The last singing bird was heard on the evening of June 3. The birds had been singing very irregularly during the preceding two weeks. Although most of the males sang regularly until the middle of May, six of them were not seen or heard after April 30. After they had been heard regularly for fourteen days, these birds (all at one end of the Barrens area) disappeared between April 17 and April 30. No predation of singing woodcocks was observed, but the fact that all the birds that vanished from the area were grouped at one end of the study tract seemed to indicate a possibility of predation or some other form of interference.

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## CANADIAN RACES OF THE GREAT HORNED OWLS

BY P. A. TAVERNER

THE Great Horned Owl, *Bubo virginianus*, is a widespread and exceedingly variable species, occurring in the Americas from the northern tree limit to the Straits of Magellan. Though the largest and heaviest of American owls, it can be regarded as a smaller edition of the great Eagle Owl, *Bubo bubo*, of the Old World. So variable is it individually that it is difficult to find two perfectly matched specimens. The predominant colors are rusty red, black and white. The rusty is usually in background or under-coat upon which the black and white pattern is superimposed. This rusty may be strong and clear or reduced in any degree through cream to pure white. The pattern below is in many narrow bars, sharp and coarse, or finer, occasionally in part reduced to vermiculation. Above, the pattern is darker than below and finely intricate, occasionally refined almost to a pepper-and-salt effect. Below, either black, or white, or red may predominate and the black may coalesce into clouds that more or less conceal the pattern. The facial disks may be full red, rusty ochre, grayish, or white and may be immaculate or flecked in varying degree with black. The legs and feet may be anything between rusty and white, and immaculate to heavily barred with black. There is no appreciable difference in plumage with sex or that at present can be ascribed to age; the downy young moult directly into the colors of the adult. Because of this, quite immature specimens are of value in racial determination.

The great amount of individual variation, and the fact that most museum specimens are winter-taken when migration or wandering has inextricably mixed the races, have hitherto made detailed study of the species difficult. Some of the perplexing variation in the species has been ascribed to a black dichromatism, but the study herewith indicates that racial hybridism is a more probable explanation. The National Museum of Canada over a series of years has made special effort to collect breeding birds or those assumed to be breeding, from all parts of the Dominion and it seems that the number (about eighty-five in all) amassed, reinforced by other material, is now sufficient to fill out a reasonably accurate picture.

A cursory examination of this series shows that across the northern part of the continent there are three very distinct types,—a medium-colored one in which red more or less predominates, a very dark one saturated with much black, and a very white one. These have

broadly marked geographical distributions but show considerable variation and the sporadic occurrence of intrusions of more or less strongly marked extra-racial forms.

Probable causes of this high variability and heterogeneity are not far to seek. The Horned Owl as a species is generally sedentary, found on the same station summer and winter. But in winter there is much wide ranging of individuals, probably a wandering for food that may be nearly regular enough to be regarded as an incipient or relict migration. Much of this wandering is undoubtedly aimless and unoriented as indicated by the irregularity of immigrant occurrences, but the general shift of owl population is from severe to milder conditions and approximately, or ecologically, southward. Probably this seasonal movement is more marked in northern populations than in southern ones though in either, individuals may be born, live, and die within narrow geographical limits.

The species breeds very early in the season, in North America often while winter conditions still prevail, but not simultaneously over its great climatic range. The more-northern breeding areas are not open for the purpose until considerably after southern residents are well into incubation or even farther advanced in their breeding cycle. It follows that northern individuals as yet without necessity to return to their ancestral homes may find themselves still in foreign country and surrounded by an actively mating population. It is not at all unlikely that such a stranger, perhaps with somewhat advanced sexual development, may be excited by example and be 'seduced' into pairing with an aggressively amorous local mate. This might not happen often enough to mongrelize seriously entire populations but would set up permanent instability in local genetic structures that would explain the occurrence of anomalous specimens in generally homogeneous populations, and initiate a high degree of variability in succeeding generations. Foreign genes introduced into a strain are self-perpetuating and probably are never entirely eliminated. Probably most strains of Horned Owls are heterozygous and contain latent foreign genes that sporadically may become dominant. If we feel bound to name every possible genetic combination that may be developed, the possibilities therefore are infinite in the species but it would make our system so complicated that it would tend to conceal instead of reveal the fundamental structure.

In studying populations in such mobile forms as birds, breeding stock is practically essential, but it should be borne in mind that mere summer residence is not certainly indicative of local breeding though it may be favoring evidence. It is not known at what age

Horned Owls come to breeding maturity, but from analogy with other large species it is not unlikely that it may take more than a single year. If so, yearlings or sub-matures without reproductive urge may delay their return to their proper breeding habitat and may summer in foreign lands. This is true of some other species of prolonged adolescence that do not invariably return to nesting localities until sexually mature and ready to breed. However, in spite of this, it seems safe to assume that when numbers of a reasonably constant type are found summering together they represent the normal type of that area. In the following study this has been assumed where actually ascertained breeding specimens are lacking.

In the series at hand some 275 specimens have been available, mostly from the collection of the National Museum of Canada representing localities from The Labrador to the islands of British Columbia and from the International Boundary north to the tree limit. Besides these, numerous specimens have been examined in or from other collections, notably the U. S. National Museum (U.S.N.M.), The Royal Ontario Museum of Zoology (R.O.M.Z.), the Quebec Provincial Museum. (Que. Prov. Mus.), the Carnegie Museum and others that the writer has been privileged to visit. He wishes to express his appreciation of these courtesies.

As said before, these specimens are divisible into three well-marked color types: a black, saturated type; a medium, reddish one; and a very white type, agreeing generally with the races recognized in the A. O. U. 'Check-list' (1931), the black with *heterocnemis*, *saturatus* and *lagophonus*; the red with *virginianus*; and the white with *subarcticus*. There is some variation in size between individuals but it does not seem consistently distinctive enough to be racially significant and is therefore disregarded.

*Red specimens referable to virginianus:*

1. Cape North, Nova Scotia, August 26, 1935.
4. Kings County, Nova Scotia, March 15; May 29; July 14; August 25.
1. Albert County, New Brunswick, August 21.
5. Prince Edward Island, (one downy) all June.
1. Pontiac County, Quebec, April 28.
9. Ottawa, Ontario, January 8, 18; February 2; March 13; April 8; October 14; November 14; December 7.
1. Kingston, Ontario, January 6.
1. Pictou County, Ontario, February 14.
1. Lanark County, Ontario, October 22.
1. Toronto, Ontario, winter.
1. Peel County, Ontario, September 28.
1. Middlesex County, Ontario, November 7.

- 1, Bruce County, Ontario, June 4 (R.O.M.Z.).
- 3, Kingsville, Ontario, January 4; April 14; December 28.
- 2, Point Pelee, Ontario, March 2, 30.
- 1, Kapuskasing, Ontario, June 20.
- 1, Manitoulin Island, Ontario, September 5.

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Though there are few breeders or potential breeders in this series, they are so consistently similar that there is little doubt that they represent the dominant form for the respective localities. They grade into some very strongly red birds probably most markedly in the far-eastern Nova Scotia group of which the Cape North specimen is the extreme. In the same group some show a degree of darkening as if toward *heterocnemis* and seem to be the basis of *neochorus* Oberholser, postulated for Newfoundland and Nova Scotia, but not distinctively or consistently enough to validate the name.

*White specimens referable to subarcticus*

- 1, Bradford, Ontario, January 5 (R.O.M.Z.).
- 1, Algonquin Park, Ontario, October 12.
- 2, Toronto, Ontario, October; September (R.O.M.Z.).
- 6, Moose Factory, Ontario, one, July 12; five, winter (Carnegie Mus.).
- 2, Lake Nipigon, Ontario, both half-downy, June 23 (R.O.M.Z.).
- 1, Ingolf, Ontario, June 1 (R.O.M.Z.).
- 2, Lac Seul, Ontario, September 6, 20.
- 1, Wabigoon, Ontario, June 18 (R.O.M.Z.).
- 1, Favorable Lake, Ontario, November.
- 1, Ochre River, Manitoba, April 3 (R.O.M.Z.).
- 1, Lake St. Martin, Manitoba, June 26 (R.O.M.Z.).
- 7, Winnipeg, Manitoba, no date, probably winter.
- 1, Shoal Lake, Manitoba, September 1.
- 11, Oak Lake, Manitoba, juv. July 7; family both parents and two half-downies, July 11, 21; juv. and parent August 10; October 3, 13; November 27.
- 2, Mulvihill, Manitoba, March 15, 22.
- 2, Dauphin, Manitoba, nest mates half-downy, June 10.
- 3, Swan River, Manitoba, family parent and 2 half-downy, July 7.
- 1, Cormorant Lake, Manitoba, September 4.
- 5, Thicket Portage, Manitoba, family two parents and half-downy, August 23, 27, 29.
- 1, Herb Lake, Manitoba, November 2.
- 1, Eastend, Saskatchewan, June 21.
- 3, Cypress Lake, Saskatchewan, family two parents and half-downy.
- 1, Watrous, Saskatchewan, August 3.
- 1, White Bear Lake, Saskatchewan, September 18.
- 20, Red Deer River, Alberta, between Red Deer and Steveville; June 14, 17; family parent and half-downy, June 26, 29; July 7, 8, 17, 29; mated pair July 31; August 22, 26; September 24, 25.

3. Rosebud, Alberta, March 22; May 26; February 21.
  1. Camrose, Alberta, November 2.
  2. Waterton Park, Alberta, downy, May 29; June 4.
  1. Edmonton, Alberta, June 11.
  6. Lac la Nonne, Alberta, May 25; June 11, 12, 14; half-downy, June 15; September 10.
  4. Wood Buffalo Park, Alberta, April 25, 26; downy, June 17; October 27.
  1. Tazin and Talton Rivers, Northwest Territory, half-downy, June 19.
  1. Chesterfield Inlet, Northwest Territory, June 10.
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Many of these birds are assumed breeders and a considerable number are demonstrated as such. Several complete families are represented by one or more parents and their young. An interesting thing in these family groups is that the young are not always identical with their parents or even with their nest mates. In the case of the family, parents and two half-downies, Oak Lake, this is most marked, one of the juveniles, unlike the other members of its immediate family, being quite heavily red in the under coat. With its parentage or locality unknown it would easily pass for *occidentalis* to which a number of our mid-western specimens have been referred. A point of note is that this form does not seem to grow whiter northward; the whitest birds come not from the north where they might be expected, but from close to the International Boundary, Cypress Lake, Saskatchewan, and the lower Red Deer River, Alberta.

Of the dark birds there are two groups separated by the whole width of the continent making no contact with each other except through an entirely dissimilar intervening race. The one occupies The Labrador and an uncertain part of eastern Quebec and the Ungava Peninsula while the other occupies the trans-mountain region of British Columbia. The former is referable to *heterocnemis*, the latter is divided between *saturatus* and *lagophonus* of the 1931 A. O. U. 'Check-list.' Though we can find absolutely no consistent racial distinction in size or color between these widely separated groups they can be listed separately on the basis of geography.

*Dark eastern birds referable to heterocnemis*

4. Bonne Esperance, Quebec, north shore, Gulf of St. Lawrence, winter.
1. Harrington Harbor, Saguenay County, Quebec, March.
1. Johan Beetz Bay (= Piasstre Bay), Saguenay County, Quebec.
2. Johan Beetz Bay, Quebec, no date (Que. Prov. Mus.).
1. Moisie River, Saguenay Co., Quebec, August.
1. Swamp River, central Ungava, August 7 (Carnegie Mus.).
1. Fort Nasapee, Labrador (locality?), no date (U.S.N.M.).

- 1, Ste. Anne de la Perade, Quebec, November 19 (Que. Prov. Mus.).
- 1, Portneuf, Quebec, March 8 (Que. Prov. Mus.).
- 1, Lac Tergent, Quebec, December 28 (Que. Prov. Mus.).
- 1, St. Eugene, Ontario, no date (Que. Prov. Mus.).
- 3, Ottawa, Ontario, two March, November 8.
- 1, St. Thomas, Ontario, December 21.
- 1, Peterborough County, Ontario, November 1 (R.O.M.Z.).
- 1, Peel Co., Ontario, December 15 (R.O.M.Z.).
- 1, Toronto, Ontario, no date (R.O.M.Z.).

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In literature various authors unhesitatingly refer birds on the outer Labrador coast to *heterocnemis*. Little is known of the owls of the interior of Ungava and it is uncertain how far inland or westward this dark influence extends. Specimens in the United States National Museum from Chimo do not appear to be strongly dark and suggest intergradation, probably toward *subarcticus*. Newfoundland specimens not being available, no conclusion can here be reached regarding them. The proposed race *neochorus* Oberholser (Proc. Biol. Soc. Washington, 27: 46, 1914) seems by description, geography, and the specimen from Cape North, Nova Scotia, listed here as *virginianus*, to be an intergrade between that race and *heterocnemis* and seems to have been so accepted by other recent authors.

#### DARK WESTERN BIRDS, *saturatus* AND *lagophonus* OF THE 'CHECK-LIST'

These two races, as recognized by the 1931 'Check-list' and most authors, are separated by purely quantitative characters, according to the amount of blackness they exhibit. Some difference in average size has been postulated but on measuring the series this has been found immaterial. Being unable to correlate color with any pronounced geographical distinction, we cannot think that there is any valid taxonomic difference between them but, for the purpose of demonstration, they are here listed separately. As they intergrade, the divisional point between them is largely a matter of opinion and convention, but viewing them in mass the following seems a substantially correct separation.

##### *Darkest birds, saturatus of 'Check-list':*

- 2, Sayward, Vancouver Island, British Columbia, mated, August 17.
- 1, Campbell River, Vancouver Island, B. C., half-downy, July 4 (H. M. Laing).
- 1, Victoria, Vancouver Island, B. C., November 15 (Arthur Peake coll.).
- 1, Cape Lazo, Vancouver Island, B. C., January 3 (Arthur Peake coll.).
- 2, Victoria, Vancouver Island, B. C., November 15, December 7.
- 1, Craig Crossing, Vancouver Island, B. C., October 28.

- 1, Comox, Vancouver Island, B. C., February 16 (H. M. Laing).
- 1, Campbell River, Vancouver Island, B. C., half-downy, July 4.
- 1, Quatsino, Vancouver Island, B. C., December 16.
- 1, Stui, B. C., (coastal), July 21.
- 2, Hagansborg, B. C., (coastal), parent and half-downy, July 9.
- 1, River's Inlet, B. C., (coastal), August 31.
- 2, Lilloet, B. C., (interior), July 4; August 14.
- 1, Vaseaux Lake, B. C., (interior), May 27.
- 2, Okanagan Landing, B. C., (interior), half-downy, June 18; October 27.
- 1, Creston, B. C., (interior), August 16.
- 1, Cranbrook, B. C., (interior), October 6 (R.O.M.Z.).
- 1, Teslin Lake, B. C., (north interior), September 4.
- 1, Corvallis, Oregon, November 17.

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It can be stated that some of the most darkly characterized specimens breed in the farthest interior while some of the coastal breeders show decided tendency toward the next group. In other words interior birds are not necessarily intergrades.

*Medium-Dark Birds, lagophonus of 'Check-list'*

- 2, Comox, Vancouver Island, B. C., January 1; December 12.
- 1, Mittlenach Island, (coastal), May 23 (Carnegie Mus.).
- 1, Stillwater, B. C., (coastal), July 16.
- 1, Hagansborg, B. C., (coastal), July 5.
- 1, Brackendale, B. C., (coastal), half-downy, July 13.
- 1, Penticton, B. C., (interior), April 10.
- 1, Osoyoos, B. C., (interior), September 25.
- 3, Vaseaux Lake, B. C., (interior), May 31; two half-downy, June 1.
- 1, Westbridge, B. C., (interior), September 8.
- 1, Rossland, B. C., (interior), July 5.
- 2, Newgate, B. C., (interior), May 10, 26.
- 1, Creston, B. C., (interior), August 16.
- 2, Fort Nelson, B. C., (interior), half-downy, June 13, 14.
- 3, Teslin Lake, B. C., (north interior), half-downy, July 27; two August 27.
- 1, Duncan, Oregon, October 19.
- 1, Corvallis, Oregon, January 9.

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A comparison of these two series of occurrences shows that while heavily colored birds may predominate on Vancouver Island and adjacent coasts, similar ones appear and breed indiscriminately and with lighter ones in the interior of the province and the converse. Nowhere within the range of this examination is there a more than approximately pure population of either type. It seems better on these grounds therefore taxonomically to combine the two and as *saturatus* has priority, to relegate *lagophonus* to synonymy.

Besides these plainly marked birds that are easily referred to their proper races are a number that fit none of the categories and are best explained as intergrades or hybrids between them. The racial components of these mixtures are not always apparent and some are probably quite complicated involving various influences of more than two strains. This is particularly true in eastern Ontario and southern Quebec adjacent to the meeting of three forms, *virginianus*, *heterocnemis* and *subarcticus*. In general one can say that a predominance of red suggests *virginianus* influence; black, *heterocnemis*; and white, *subarcticus*; but the relative importance of each in some specimens is difficult of analysis and the exact parentage of a few of the following therefore may be open to reasonable question.

*virginianus*  $\times$  *heterocnemis*

These show considerable red of *virginianus* and black of *heterocnemis*. Strangely enough they show sharper and clearer whites than either, suggesting that there may be a strain of *subarcticus* in them. The facial disks are more or less, to occasionally, strongly reddish. The feet are usually reddish but may be gray or cream and lightly to heavily barred. One specimen that might be included among them, the Cape North, Nova Scotia, bird in the *virginianus* list is dark but very strongly red with little white. The proposed *neochorus* Oberholser of Newfoundland may be of some such intermediate type.

- 5, Beaupré, Quebec, February 16; November 4, 7, 27 (Que. Prov. Mus.).  
1, Charlesburg, Quebec, December 11 (Que. Prov. Mus.).  
1, Isle de Orléans, Quebec, December 15 (Que. Prov. Mus.).  
1, Prescott County, Ontario, December (Que. Prov. Mus.).  
1, Toronto, Ontario, January 26 (R.O.M.Z.).

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9

*virginianus*  $\times$  *subarcticus*

These are largely white birds with more or less, to considerable, red in the under coat, but as *subarcticus* seems dominant over *virginianus* and the blacks are often conspicuous, a few are not to be certainly separated from *subarcticus*  $\times$  *heterocnemis* stock. The red tendency however does appear in greater or less degree in much reasonably pure *subarcticus* population. In a family from Oak Lake, Manitoba, one nestling shows it strongly while nest mates and parents do not, suggesting genetic heterogeneity probably derived from the southeast through Minnesota rather than from the east by way of Ontario. These are doubtless the origin of the *occidentalis* that have been frequently ascribed to southern Canada.

6. Toronto, Ontario, January 12; February 25; October 24, 28; November 20; December 28 (R.O.M.Z.).
  1. Peel County, Ontario, October 28 (R.O.M.Z.).
  1. Hastings County, Ontario, date? (R.O.M.Z.).
  1. Muskoka District, Ontario, September 7 (R.O.M.Z.).
  1. North Bay, Ontario, October (R.O.M.Z.).
  3. Winnipeg, Manitoba, no dates, probably winter.
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13

There is a very uniform and common type of apparent intergrade or hybrid. It is strongly black and white, too dark for *subarcticus*, too white for any other race referred to here and with little or no red of *virginianus*. The facial disks are usually clear gray, often reddish gray, occasionally grayish red. The feet are white to light gray, occasionally slightly buffy and usually more or less barred with blackish. The type occurs practically in identical character on both sides of the continent, more rarely in the mid-section between. It is consistent and numerous but, except in northern British Columbia and the Yukon, without ascertained breeding locality. We refrain from attempting to raise it to the distinction of a separate race though many forms have been so described on slighter evidence. We prefer to regard them as hybrids between *subarcticus*, and *heterocnemis* and *saturatus* respectively and list them separately with distinction based upon geography.

*subarcticus*  $\times$  *heterocnemis*

1. Brador Bay, Saguenay County, Quebec, December 11 (Que. Prov. Mus.).
  2. Beaupré, Quebec, November 2, 4 (Que. Prov. Mus.).
  1. Cap Rouge, Quebec, December 23 (Que. Prov. Mus.).
  5. Ottawa, Ontario, November 19 (date?); December 3, 15, 28.
  2. Prince Edward County, Ontario, January 13; December 2 (R.O.M.Z.).
  2. Coldstream, Ontario, February 8, 26.
  3. Toronto, Ontario, January 26; February 10; December 24 (R.O.M.Z.).
  1. Collingwood, Ontario, November (R.O.M.Z.).
  1. Preston, Ontario, March 21.
  1. Sunbridge, Ontario, April 10 (R.O.M.Z.).
  1. Favorable Lake, Ontario (near Manitoba line, half-way to Bay), July 24.
  1. Savanne, Ontario (in Port Arthur, Lake Superior region), July 14 (R.O.M.Z.).
- 

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The first and last of this series are of well-marked character and of particular interest, both being far from their expected habitats, the latter summering in the midst of a strongly characterized population of practically pure *subarcticus*, the former occurring well within

the apparent stronghold of *heterocnemis*. They demonstrate the irregular wandering and lingering of individuals far afield and give evidence to the theories previously stated.

The next group is practically identical with the last but from geographical reasons is listed separately.

*subarcticus*  $\times$  *saturatus*

- 1, Swift Current, Saskatchewan, September 7.
- 1, Red Deer, Alberta, July 5.
- 1, Rosebud, Alberta, May 26.
- 1, Beyon, Alberta, November 24.
- 1, Camrose, Alberta, December 19.
- 1, Waterton Lake Park, Alberta, February 1.
- 1, Lac la Nonne, Alberta, May 29.
- 2, Wood Buffalo Park, Alberta, April 1; May 11.
- 2, Mackenzie Delta, Northwest Territories, October 28; November 1.
- 1, Barter Island, Alaska (north coast), fall.
- 3, Teslin Lake, British Columbia (north interior), September 1, 28; half-downy, July 28.
- 1, Barriere, B. C., (central interior), June 13 (Carnegie Mus.).
- 1, Victoria, Vancouver Island, B. C., March 7.

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Besides these, Bishop proposes a new form based upon several winter specimens from southern Vancouver Island under the name of *leucomelas* (Proc. Biol. Soc. Washington, 44: 93, 1931). By description this can hardly be separated from the above and, until a center of pure culture for it is located, can probably be regarded as an intergrade as above. Swarth in his 'Birds of Atlin' (Univ. California Pub. Zool., 30: 1926, and Proc. California Acad. Sci., 22: 1936) notes both *lagophonus* and *subarcticus* and states that both types can be found in the same nest brood,—a clear case of hybrid strain and conditions similar to those in the approximately adjacent Teslin Lake district.

The two groups of hybrids with *subarcticus* from opposite sides of the continent are so much alike that they are collectively, and individually, inseparable except by geography.

There are three other very puzzling specimens,—

- 1, Red Deer River, Alberta, no date.
- 1, Mouth of Salmon River, southern British Columbia, September 2.
- 1, Near Nanaimo, Vancouver Island, B. C., August 10.

These are as nearly identical with each other and with the Cape North, Nova Scotia, *virginianus* as Horned Owls ever are. They show little white, scarcely more than an average amount of black but are strongly and predominantly red. If it were not for their unexpected geography they would unhesitatingly be passed for ultratypical *virginianus*. One hesitates to postulate eastern *virginianus* wandering across the whole continental width but the most reasonable alternative explanation seems to be that they may be dichromatic variants common to *heterocnemis* and *saturatus*. Not knowing just what to do with them we can only present them for consideration of the court.

The apparent similarity of the two dark races has been mentioned before. Divided as they are through the middle of the continent by intruding white *subarcticus* they are physically separate and distinct strains, but were they closely adjacent or in contact, no distinction between them would be suspected. Both hybridize with *subarcticus* producing similar progeny and both are suspected of a red dichromatism; all of which suggests that the gene complexes of the two groups are similar if not essentially identical. There seems no compelling reason to separate them any more than we have in the case of the Black-capped Chickadee, *Penthestes atricapillus*, and Barrow's Golden-eye, *Glaucionetta islandica*, that present the same distributional problem.

#### COMPARATIVE DESCRIPTION OF RACES RECOGNIZED

*Bubo virginianus virginianus*.—Neither darkly saturated nor strikingly pale. Its principal distinction is its comparatively large amount of rusty red. It is the reddest of the Canadian races of the species. The black and white bars below are in rather soft contrast, much less insistent than those of other races here treated. The facial disks are mostly clear rust-color, graying or gray intermixture being less usual. The feet are from reddish buff to cream, usually immaculate but often lightly barred with black.

*Range in Canada*.—Nova Scotia, New Brunswick, Prince Edward Island, southern Quebec, and southern Ontario north at least to about latitude 50° and west probably to eastern Lake Superior, but the contacts with other races have not been sharply defined.

*Bubo virginianus saturatus* (= *B. v. heterocnemis* + *B. v. saturatus* + *B. v. lagophonus* of A. O. U. 'Check-list,' 1931).—Very dark and saturated above and below, with black predominating, ultratypically tending to coalesce and extinguish pattern. These are the blackest races of the species. Usually considerable ruddy under-

coating. The black and white below usually sharply contrasted. The facial disks run from gray or reddish gray flecked with black occasionally to solid dark rusty. The feet gray to light buff more or less heavily barred with black.

*Range in the east (heterocnemis of 'Check-list').—The Labrador and an uncertain distance westward through Ungava and eastern Quebec north of the St. Lawrence River.*

*Range in the west (saturatus and lagophonus of 'Check-list').—In Canada, British Columbia, coastal islands and the mainland, intergrading or hybridizing along the eastern slope of the Rocky Mountains and the Yukon with subarcticus.*

*Bubo virginianus subarcticus.*—Very white, with little or no reddish ground or under coat below, and reds paled to shades of buff above. Mostly black and white with white predominating. The whitest of the Horned Owl races. The facial disks white to light ashy, rarely with tinge of rufous. The feet immaculate white, occasionally creamy or very light buff with light barring of blackish.

*Range in Canada.*—From southern James Bay, perhaps western Ungava, and northern Lake Superior district west to the Rocky Mountains, and from below the International Boundary north to the limit of trees.

In winter almost any of these races may appear within the range of another, may occasionally remain there through the summer and may rarely breed, setting up local foci of heterogeneity and producing intermediates or hybrids.

National Museum of Canada  
Ottawa, Ontario

THE WHISTLING THRUSHES (GENUS *Myiophonus*)

BY J. DELACOUR

## Plate 8

IN THE mountainous parts of temperate and tropical Asia and Malaysia, from Turkestan and Afghanistan in the west, east to Formosa and Borneo, and south to Ceylon and Java, one often notices along the forested banks of swift-running watercourses, on the ground, on rocks, on boulders or on low branches, peculiar dark birds, always alone or in pairs. They are the Whistling Thrushes of the genus *Myiophonus*.<sup>1</sup>

Some of them exceed slightly in size the European Mistle Thrush, while others are somewhat smaller, like the American Wood Thrush. Their wings are rather large and moderately rounded, as is their tail, which is comparatively longer in the larger birds than in the smaller ones. Their long legs and their feet are powerful and always black.

With the different forms, the bill varies much in strength, but is always slightly shorter than the head, compressed and hooked at the tip. It is within the species *caeruleus* that the greatest differences are to be found in its depth, which increases continuously and strikingly from north to south. Measured at its thickest part, just beyond the nostrils, it is 8 mm., on an average, in *c. caeruleus* (China), and reaches 15 mm. in *c. flavirostris* (Java). As to color, the bill is either black or yellow with a variable amount of black on the upper mandible. In most black-billed forms, the young show a certain amount of yellow. The nostrils are exposed, round or oval. The iris is always brown, of slightly differing shades.

All *Myiophonus* show blue in their plumage. It is reduced to shoulder patches in the females of *borneensis*, *castaneus*, and *blighi*; the male *castaneus* is half blue and half chestnut; the general coloration of all the others is a dark blue, with a greater or lesser admixture of black and purple.

By their general aspect, build and behavior, Whistling Thrushes are true turdine birds, only specialized for semi-aquatic life and particular food, but nevertheless resembling other ground thrushes. They walk, hop, run, stop, flit and open their tail and wings, cock

<sup>1</sup> I agree with C. D. Sherborn (*Index Animalium*, London, 1928: 4226-4228) that the proper spelling is *Myiophonus* Temminck and Laugier, 1822. *Myophonus* T. and L., 1822, is an orthographic error, as well as *Myophoneus* in their tables, 1839, while *Myiphonus* Agassiz, 1846, is an unnecessary emendation.

their heads, stare, turn over stones and leaves in ways closely recalling those of the European Blackbird and the American Robin, to name only two birds that are familiar to everyone. Whoever has watched them in life cannot have any doubt about their real relationships. They have little in common with the timaliine birds, always arboreal, whose legs are coarser and wings shorter. The only objection to their admission among the Turdinae is indeed more formal than real, arising from the fact that in most cases the young birds in first plumage are not plainly spotted. Those of *M. blighi*, however, are distinctly marked, having broad pale shaft-lines to their brown feathers on the head and under parts; also the immature *borneensis* is clearly streaked with white on the chest and abdomen. In all other forms, immatures are a uniform sooty or brownish black, with variable blue and purple suffusion; but they all have white or pale-brown shafts, more or less visible, on the feathers of the breast, abdomen, flank and lower back. This, I believe, is a sufficient, if not a very conspicuous indication of their affinities. Once more, however, I wish to call the reader's attention to the artificiality of family or subfamily divisions among passerine birds, particularly in the present group.

As pointed out at the beginning of this paper, Whistling Thrushes are strictly hill birds, completely absent in the plains, except during the winter along swift-flowing streams at the foot of the mountains. They live near or on the ground, in the vicinity of running water, where there is a sufficient cover of trees and bushes on which they perch at times. They feed on all sorts of invertebrates, many of which are caught in the water. Snails seem, however, to be their staple diet. The birds' strong, hooked bills are well adapted to dealing with this sort of prey; they have a habit of cracking them on a particular rock; a great heap of empty shells is found near by. They are more abundant near limestone cliffs where snails are more numerous.

All Whistling Thrushes have similar nesting habits. The nests are placed on ledges, in crevices of rocks, among boulders and logs or even among thick branches, always close to the water. They are large cups of green moss mixed with twigs and muddy roots, lined inside with thin black roots and some leaves. In China and in western India, they are sometimes built under the eaves of temples and houses. The eggs, usually three, sometimes two or four in number, resemble those of many other thrushes, particularly of the subgenus *Oreocincla*. Rather elongated, their ground-color is gray, pinkish, buff, or greenish, with indefinite spots and freckles of pale reddish brown and secondary markings of gray and lavender.

The various species have a long, full and melodious whistle, often uttered, and in India they are called the 'Whistling School Boys.' In some of the smaller species the whistle is weaker. Their alarm-note is harsh and short, not unlike that of the European Blackbird. I have never heard them sing properly either in the wilds or in captivity, but Père David and several aviculturists record a veritable song. The question of their vocal possibilities remains open, but I doubt that they can emit anything more elaborate than their well-known whistle.

All species of *Myiophonus* appear to be common in suitable situations, with the exception of *blighi*, which remains scarce in the mountain forests of Ceylon. Some forms seem to be fairly local, particularly *robinsoni*, *glaucus* and its subspecies. Some Whistling Thrushes are shy birds, but many become easily accustomed to the presence of man and are often observed in the vicinity of human dwellings when they are not molested; *horsfieldi* is particularly fearless; also, to a lesser degree, *caeruleus* and *melanurus*. A good illustration of their confiding nature is given by an amusing incident which took place during my Sixth Expedition to Indo-China in 1931–1932. At Thateng, on the Boloven Plateau in southern Laos, a torrent was rushing through the thick jungle, just back of our camp. Both subspecies, *M. c. caeruleus* and *M. c. eugenei*, were numerous along its course during the winter months. Within a few days of our arrival, we trapped a few of them and kept them on our verandah, each in a box cage. They were given biscuit meal, meat and boiled eggs, and they took readily to such food. After having remained two weeks in captivity, one *eugenei* escaped. We thought that it would quickly return to its nearby native stream. Great was our astonishment when we found that the bird did not leave the eaves of our hut, but came down to eat from the cages scraps which it evidently preferred to its natural diet. We could easily have recaptured it, but we let it remain free in order to watch its behavior. When several weeks later we left Thateng, the bird was still living in the roof. I imagine that it returned only reluctantly to the torrent when no more artificial food could be found.

The systematic arrangement of the different forms of *Myiophonus* is not simple, and there have been various differences of opinion on the subject.

As previously said, in the majority of Whistling Thrushes, the general coloration is a deep blue, with a variable admixture of black, violet and purple. Even in the few cases where brown or chestnut is dominant, there is always some blue in the plumage (shoulder

patch). In several species the body-feathers terminate in a lustrous blue spot, forming a spangle, a unique feature among thrushes. These spangles are either round or elongated, according to the species or subspecies, and also to the location on the body. They are usually pointed on the head and neck.

All *Myiophonus* show a shining blue or violet patch on the shoulder, formed by the large decomposed margins of the lesser wing-coverts, and on the bend of the wing. They have the forehead, lores, long plumelets and bristles around the bill deep black. Most of them have a silky blue band across the anterior crown, close to the forehead, but a few lack this. In the great majority of cases, both sexes are either alike or differ only slightly in the intensity of the colors, but in *blighi* the female is a uniform reddish chestnut; in *castaneus* she is also chestnut with a black crown, bluish in front, while the hen *borneensis* is dark brown. In all of them the female is slightly smaller than the male.

With the exception of *horsfieldi*, *eugenei*, *melanurus* and *blighi*, all forms possess concealed white feather-bases, running up the shafts, usually on flanks, sometimes on abdomen, breast and back. In some of them, there are indications of a white patch on the outer median under wing-coverts, but this appears to be individual.

In all forms of the *caeruleus* group except *eugenei*, and exceptionally *flavirostris*, there are also glossy white spots, more or less tinged with mauve, at the tip of the median upper wing-coverts. The larger species, including *horsfieldi* and *caeruleus*, have a proportionately longer tail than the smaller ones; but the fact that two of the small, short-tailed forms, *melanurus* and *robinsoni*, show to a greater or lesser extent the same gleaming spangles as *caeruleus*, indicates close affinities. On the other side, the large, long-tailed forms of *horsfieldi*, without spangles, are obviously nearly related to the short-tailed *glaucinus*, while they are not far removed from *caeruleus*, which they replace geographically. All these different characteristics are distributed irregularly among the different forms and cannot be used for generic distinction, all the more since *Myiophonus* has no very near relatives and forms a homogeneous group.

It seems that their closest allies are the Celebean *Heinrichia*, which, although much smaller, appears not very distant from the slenderer Whistling Thrushes, particularly *blighi*. Furthermore *Heinrichia* is nothing but a large *Brachypteryx*, very similar to *B. poliogyna* from the Philippines and *B. erythrogyna* from Borneo, in both sexes. Besides its much-reduced size, *Heinrichia* differs from *Myiophonus*

mainly in the absence of glittering blue patches on the lesser wing-coverts.

We have therefore to consider that all Whistling Thrushes should be placed in the genus *Myiohoneus* Temminck and Laugier, Planches Coloriées, 2: 29, Dec. 1822 (type: *M. metallicus* = *M. flavirostris*). *Arrenga* Lesson, 1838 (type: *Turdus cyaneus* = *M. glaucinus*) and *Myiophaga* Lesson, 1838 (type: *Pitta glauca* = *M. glaucinus*) fall into synonymy.

The American Museum of Natural History, New York, possesses large or sufficient series of all forms. Their study, supplemented by that of other specimens lent by the museums of Washington, Cambridge and Philadelphia, and by information supplied by Messrs. H. G. Deignan and R. M. de Schauensee, has led me to the following conclusions, as to their specific and subspecific status:

The two long-tailed South Indian and Formosan forms without spangles, *horsfieldi* and *insularis*, are conspecific.

All the large, long-tailed spangled forms of the Asiatic and Malaysian countries (*caeruleus*, *temmincki*, *turcestanicus*, *eugenei*, *crassirostris*, *dicrorhynchus*, *flavirostris*) are likewise conspecific, notwithstanding anomalies of distribution due to migration, intergradation and seasonal overlapping.

Among the short-tailed forms, *robinsoni* is best considered a separate species. It has a yellow bill, a primitive character found in several forms and appearing in the immatures of others; it seems to be the most generalized bird in the whole genus.

Three others, *glaucinus* (Java), *borneensis* (Borneo) and *castaneus* (Sumatra), are conspecific in spite of marked differences in color. Their proportions are the same, and also their retiring habits. While the male and the female *glaucinus* are nearly alike and the sexes differ in the two others, the dark-brown female of *borneensis* provides a transition, and fresh adult males of *glaucinus* and *borneensis* are very similar, the latter being only a little larger, duller, and having no lustrous blue band on the anterior crown. The blue tinge disappears to a great extent in old specimens of *borneensis*; those in the American Museum, collected on Kina Balu by J. Whitehead in 1888, hardly show any, while two birds in Cambridge, obtained at the same place by J. A. Griswold, Jr., in August 1937, are almost as blue as fresh *glaucinus*. All three forms have large white bases to the feathers on the breast, abdomen and back.

*M. melanurus*, from Sumatra, is a very unusual species, slender, with a short bill, very bright colors and spangles, and no white feather-bases.

The Ceylon bird, *M. blighi*, although related to *glaucinus*, is much smaller, has no blue on the anterior crown and no white on feather-bases. The female and the young are conspicuously different. It is better to consider it a valid species.

It is interesting to note that no *Myiochromeus* occurs on the island of Hainan, and that the Malaysian countries are the richest in species: Malay Peninsula, two; Sumatra, three; Java, two; while continental Asia, Formosa, Borneo and Ceylon have only one each.

Evidently Sumatra and the lower Malay Peninsula which, zoogeographically speaking, constitute but one natural region, are the center of distribution of the genus. Of the four different species inhabiting this area (*M. c. dicrorhynchus*, common to both the peninsula and the island; *robinsoni*, Malay Peninsula; *castaneus* and *melanurus*, Sumatra), *M. robinsoni*, restricted in range to the mountains of Selangor, appears to be the most generalized and consequently the central form, possessing nearly all the characteristics of the others, without their being very highly developed. In the dimensions of wings, tail, bill and legs, as well as in its color pattern, it occupies an intermediate position between them all. On the other hand, *M. blighi*, from Ceylon, appears to be the most primitive form now living, the nearest to *Heinrichia* and *Brachypteryx*, from which *Myiochromeus* probably was derived. It must be pointed out here that if the long-tailed *M. caeruleus* and *M. horsfieldi* superficially resemble some forms of *Turdus*, they are not really closely related to them, while through *robinsoni*, *glaucinus* and *blighi* they are linked to *Brachypteryx*.

The following diagram gives an idea of the affinities of the different species and subspecies of *Myiochromeus*, as they exist today:

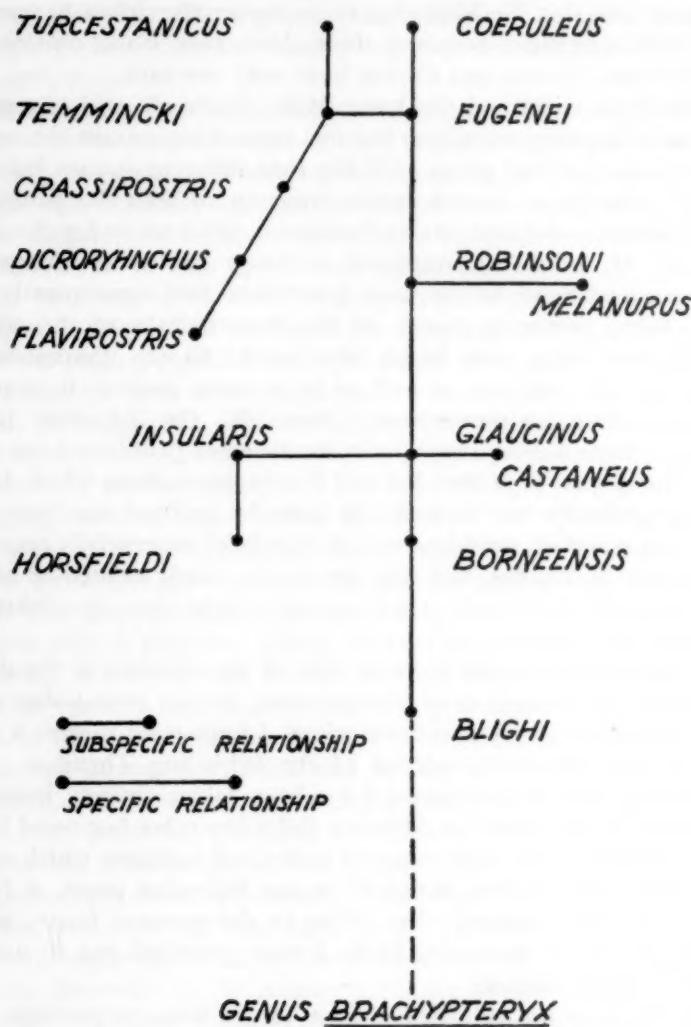
In the following key and descriptions, I have tried to give a summary of our present knowledge of the Whistling Thrushes. The descriptions and measurements have been taken entirely from the good series of the American Museum and a few other borrowed birds. In all forms there is a wide range of individual variation which might prove even greater than indicated in the following pages, if larger series could be examined. But owing to the personal factor, which always prevails in measuring birds, I have preferred not to use the records of other authors.

The length of the culmen has been quoted from its junction with the skull, and the depth of bill as given is the greatest diameter between the tip and the nostrils, close to the end of the latter.

Additional notes and information from literature have been utilized. My thanks are due to Dr. Ernst Mayr, whose opinions have been

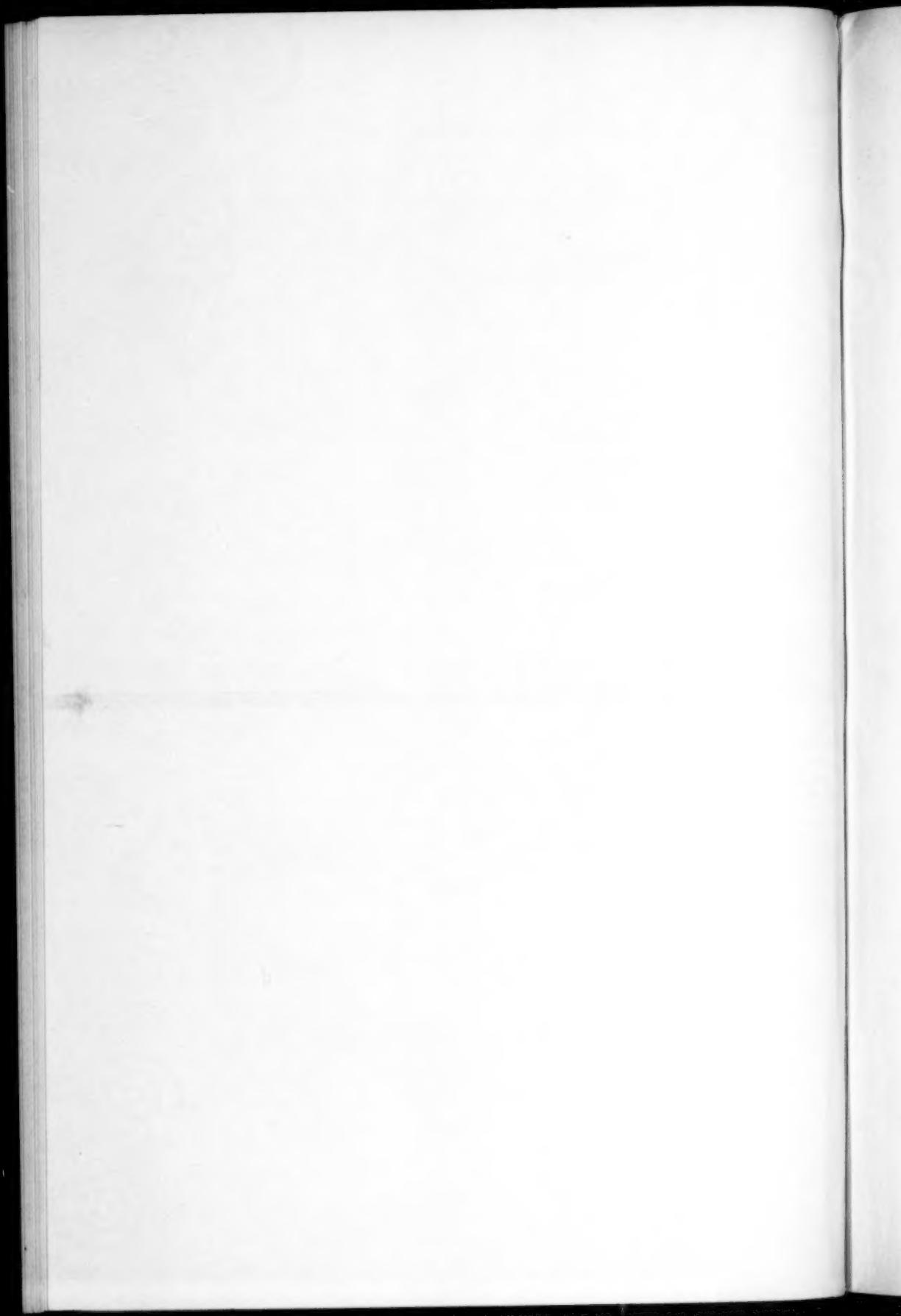
Auk  
April

*DIAGRAM OF SPECIES AND SUBSPECIES  
OF THE GENUS MYIOPHONEUS*





WHISTLING THRUSH, *MYIOPHONEUS CAERULEUS TEMMINCKI*



welcome in the study of these birds, and who has kindly consented to read this paper before it was sent to press.

*Key to Species and Subspecies*

- I. Tail longer than 112 mm.
  - 1. Body feathers without spangles
    - A. Anterior crown bright blue ..... *horsfieldi*
    - B. Anterior crown dull blue ..... *insularis*
  - 2. Body feathers terminated by a spangle
    - C. Bill black ..... *caeruleus*
    - D. Bill mostly yellow
      - a. No white spots on median wing-coverts ..... *eugenei*
      - b. White spots on median wing-coverts
        - a' Bill slender (depth: 9–10 mm.)
          - a'' Smaller and brighter (wing: 159–180 mm.) ..... *temmincki*
          - b'' Larger and duller (wing: 178–200 mm.) ..... *turcstanicus*
        - b' Bill thick (depth: 12–13 mm.)
          - c'' Spangles large (abdomen black) ..... *crassirostris*
          - d'' Spangles small (abdomen brownish) ..... *dicrorhynchus*
        - c' Bill very thick (depth: 14–15 mm.) ..... *flavirostris*
  - II. Tail shorter than 105 mm.
    - 1. Spangles present
      - A. Bill short and black ..... *melanura*
      - B. Bill long and partly yellow ..... *robinsoni*
    - 2. No spangles
      - C. General coloration blue and black
        - a. Anterior crown black ..... *blighi*
        - b. Anterior crown dark blue ..... *borneensis ♂*
        - c. Anterior crown bright blue ..... *glaucus*
      - D. General coloration blue and brown, or chestnut, with a blue shoulder-patch
        - d. Head, neck and breast blue, rest of plumage chestnut *castaneus ♂*
        - e. Crown blackish, rest of plumage chestnut ..... *castaneus ♀*
        - f. Whole plumage reddish brown ..... *blighi ♀*
        - g. Whole plumage dark brown ..... *borneensis ♀*

I. *MYIOPHONEUS HORSFIELDI*

1. *Myiophonus horsfieldii horsfieldi*

*Myophonus horsfieldii* Vigors, Proc. Zool. Soc. London, 1831: 35: Malabar.

*Description*.—Anterior crown bright glistening blue; head and neck black; upper parts dark blue, the lesser wing-coverts forming a glistening bright-blue patch; throat, foreneck and upper breast black; lower breast, flanks and abdomen mottled blue and black, the feathers having broad blue tips. Bill black.

*Dimensions*.—Wing, 143–160; tail, 112–121; tarsus, 42–47; culmen, 30–34; depth of bill, 8 mm.

*Distribution*.—Western India, from Mt. Abu south to Travancore and east to the Nilghiris. Non-migratory.

2. *Myiophonus horsfieldi insularis*

*Myiophonus insularis* Gould, Proc. Zool. Soc. London, 1862: 280: Formosa.

*Description*.—Resembles *M. h. horsfieldi*, but larger, with higher legs; anterior crown darker and duller blue; upper parts dull black; breast and abdomen appearing bright blue, the feathers having very broad blue tips; concealed white base to rump feathers and greater under wing-coverts.

**Dimensions.**—Wing, 156–170; tail, 116–135; tarsus, 51–55; culmen, 31–34; depth of bill, 9–10 mm.

**Distribution.**—The mountains of Formosa. Resident.

**Note.**—It is astonishing that the close affinity between *horsfieldi* and *insularis* seems to have, so far, escaped notice. In spite of the strange distribution of the two forms, they evidently constitute local races of the same species.

Geographically, they take the place of *caeruleus*, but the two groups of birds differ so widely in color pattern that it is impossible to link them more than generically. At the same time, *horsfieldi* is undoubtedly rather closely related to *glaucinus*.

## II. MYIOPHONEUS CAERULEUS

### 1. *Myiophoneus caeruleus caeruleus*

*Gracula caerulea* Scopoli, Del. Flor. Faun. Ins., 2: 88, 1786: China, restricted to Canton.

*Myiophoneus caeruleus immansuetus* Bangs and Penard, Occas. Papers Boston Soc. Nat. Hist., 5: 147, Feb. 27, 1925: Ichang, Hupeh.

**Description.**—Whole plumage dark violet blue, each feather marked at the end with a shining spot, except on the lores, abdomen, under tail-coverts, wings and tail; lesser wing-coverts brighter, silvery blue; median wing-coverts with a metallic white spot at the tip; feathers of the flanks with a variable amount of white on the base and shaft, sometimes extending to feathers of lower back and lower breast. Inner webs of tail- and wing-feathers black. Bill small, black.

**Dimensions.**—Wing, 158–178; tail, 114–132; tarsus, 47–54; culmen, 29–32; depth of bill, 8–9 mm.

**Distribution.**—The whole of China, breeding everywhere except in western Szechuan and in Yunnan, where it is a winter migrant, as it is also in northeastern Indo-China and northwestern Siam. Partly migratory. Rare in the north of its range (La Touche).

The western and northern birds (Szechuan, Hupeh, etc.) have been separated by Bangs and Penard under the name of *immansuetus*, as being duller in coloration, with more grayish spangles. But I agree with Deignan and Greenway that no differences can be discerned when sufficient series are examined, and the type of *immansuetus* (Mus. Comp. Zool., Cambridge, Mass.) cannot be distinguished from many topotypical *caeruleus*. The alleged characteristics are due, once more, to the state of preservation of the skins and above all to the season in which they have been collected. In all forms of *caeruleus*, the more or less ultramarine, violet and silvery tinge of specimens depends upon the season to a very great degree and changes tremendously as time goes on after the moult, without relation to geographical distribution. Foxing in old skins is not very great. On

the whole, however, *caeruleus* is a more silvery and violet bird than the other subspecies, except *turcestanicus*.

### 2. *Myiophoneus caeruleus eugenei*

*Myiophoneus eugenei* Hume, Stray Feathers, 1: 475, 1873: Pegu.

*Myiophoneus stonei* de Schauensee, Proc. Acad. Nat. Sci. Philadelphia, 87: 469, 1929: Chengmai, northwestern Siam.

?*Myiophoneus klossi* Robinson, Ibis, 1915: 250: Koh Mehse, Western Island, eastern Siam.

**Description.**—Similar to *M. c. caeruleus*, but larger, of a brighter and clearer blue; no white spots on median wing-coverts, no white on base of flank feathers (a characteristic linked to white wing-spots in the species *caeruleus*); a larger, heavier bill, bright yellow, with some black on the culmen and at the base.

**Dimensions.**—Wing, 165–181; tail, 123–158; tarsus, 48–54; culmen, 34–37; depth of bill, 9–10.5 mm. One exceptionally large male from Hoixuan (northern Annam) has a wing of 188 mm.

**Distribution.**—Burma, east of the Irrawaddy; Yunnan; western Szechuan (where it intergrades with *c. caeruleus* near Tatsienlu and Washan); northwestern Siam, northeastern and central Indo-China. In southeastern Siam and western Cambodia, and also once in Peninsular Siam and in south-central Siam, it has been found in the winter (December and February), probably on migration, twice within the range of *crassirostris*.

On the western border of its range, it intergrades with *temmincki*, and on the northeastern, with *caeruleus*. Mostly sedentary, moving southward occasionally during the winter.

**Note.**—*Myiophoneus klossi* was described by Robinson from the Western Island of Koh Mehse, off the coast of eastern Siam, from one specimen resembling *eugenei*, but having pure-white lores and throat, and white bases to the feathers of the abdomen. Until more specimens are collected, it seems wiser to consider this bird as an abnormal, semi-albinistic *eugenei*, just as the so-called *Cochoa rothschildi* is only a color phase of *Cochoa viridis*, appearing here and there within the range of that species. If, however, it was found that it is a local mutation, stable on the island, *M. klossi* would have to be recognized as a good subspecies of *caeruleus*.

### 3. *Myiophoneus caeruleus temmincki*

*Myiophoneus temminckii* Vigors, Proc. Zool. Soc. London, 1831: 171: Himalaya.

*Myiophoneus tibetanus* Madarász, Ibis, 1886: 145: Central Tibet.

*Myophonus caeruleus rileyi* Deignan, Proc. Biol. Soc. Washington, 51: 25, 1938: Doi Angka, northern Siam.

**Description.**—Similar to *eugenei*, but with white spots on the median wing-coverts and white bases and shafts to flanks and sometimes other feathers as in *caeruleus*. Differences in the thickness of bill between *temmincki* and *eugenei* are not constant, as Ticehurst (Ibis, 1938: 398) has pointed out.

**Dimensions.**—Wing, 159–180; tail, 116–141; tarsus, 48–54; culmen, 31–40; depth of bill, 9–10 mm. One male from Mt. Victoria is very large, having a wing of 187 mm. According to Stresemann, the two females collected with it (1938) measure 184, 177 mm.

**Distribution.**—Eastern Afghanistan and the Himalayas, Assam, Burma, west to the Irrawaddy, Tibet, western Szechuan. Found sparsely on high mountains in northwestern Siam, South Shan States and eastern Burma, probably on winter migration, within the territory of *eugenei*. Mostly sedentary, but some probably move southeast during the winter, which explains their presence in the area occupied by *eugenei*.

#### 4. *Myiophoneus caeruleus turcestanicus*

*Myiophoneus temmincki turcestanicus* Zarudny, Ornith. Monatsber., 1909: 168: Russian Turkestan.

**Description.**—Similar to *temmincki*, but duller generally, with longer wings and tail.

**Dimensions.**—Wing, 178–200; tail, 140–164; tarsus, 48–52; culmen, 34–36; depth of bill, 9 mm.

**Distribution.**—Russian Turkestan, eastern Tianschan, Alai, Ferghana, Bukhara, north to the Alatau-Transilien chain. Appears to be sedentary, and according to Dementiev (*Systema Avium Rossicarum*) extending its range northward.

#### 5. *Myiophoneus caeruleus crassirostris*

*Myiophoneus crassirostris* Robinson, Bull. British Ornith. Club, 25: 99, 1910: Trang, Peninsular Siam.

*Myophonus temminckii changensis* Riley, Proc. Biol. Soc. Washington, 41: 207, 1928: Koh Chang Is., southeastern Siam.

**Description.**—Similar to *temmincki*, but with a larger, higher, heavier bill, and more white on the base and up the shaft of the feathers of the lower back, flanks and abdomen.

**Dimensions.**—Wing, 167–180; tail, 123–141; tarsus, 49–51; culmen, 32–36; depth of bill, 12 mm.

**Distribution.**—North of the Malay Peninsula from Bang Tapan in the north, south to Patani and the Langkawi Islands; also the extreme southeast of Siam and neighboring islands. A few *eugenei* (?) have been found in December within or near the range of *crassirostris*, but they represent very likely only stray migrants, like those found on the mountains of southwestern Cambodia and another one (February) in south-central Siam.

Deignan has compared the type and topotypes of *changensis* with series of *crassirostris* and agrees with Kloss and myself that they are all identical when account is taken of season, age and wear.

#### 6. *Myiophoneus caeruleus dicrorhynchus*

*Myophonus dicrorhynchus* Salvadori, Ann. Mus. Civ. Stor. Nat., Genova, 14: 227, 1879: Padang Highlands, Sumatra.

**Description.**—Spangles very small and rather dull; lesser wing-coverts dull bluish purple; very small and dull white spots on middle wing-coverts; upper parts dull purplish black; under parts brownish; large white bases to flank, abdomen, lower

breast and lower-back feathers; large yellow bill with black on culmen. The dullest race. Immature birds are dull black all over, with a little blue suffusion on the primaries only, and a white base to body feathers.

*Dimensions*.—Wing, 165–187; tail, 112–123; tarsus, 50–55; culmen, 35–41; depth of bill, 12–13 mm.

*Distribution*.—Sumatra and the southern half of the Malay Peninsula, north to Patani, from the foothills to 3,000 feet.

#### 7. *Myiophonus caeruleus flavirostris*

*Turdus flavirostris* Horsfield, Trans. Linn. Soc. London, 13: 149, 1821: Java.

*Myophonus metallicus* Temminck, Pl. Col., 170, 1823: Java.

*Description*.—Resembles *crassirostris*, but a little more purplish, with smaller and narrower spangles, almost invisible on the head; lesser wing-coverts somewhat less-bright blue; spots on median wing-coverts small, either blue or white, and a very large bill. Immatures are dull black, with blue suffusion on the wings and tail.

*Dimensions*.—Wing, 160–182; tail, 120–133; tarsus, 48–54; culmen, 36–42; depth of bill, 14–15 mm.

*Distribution*.—Mountains of Java, up to 3,500 feet.

#### REMARKS ON THE SPECIES *caeruleus*

The position of the different forms which I have grouped above as subspecies of *M. caeruleus* has been complicated by the fact that several of them have been found in the same territory.

In western Szechuan, Weigold has collected a series of mixed and intermediate specimens which have been well studied by Stresemann ('Zoologische Ergebnisse der Walter Stötznerschen Expeditionen nach Szetschwan, Osttibet und Tschili,' Abh. u. Berichte des K. Zool. u. Anthropol. Mus. zu Dresden, 16: no. 2, 28–29, 1923–24). Translated extracts of his commentary are given here:

"*Myophonus caeruleus caeruleus* (Scopoli).

"*Myophonus caeruleus eugenei* Hume.

"The series collected by Weigold in W. Szechuan affords unusual interest because it shows that two forms, which formerly had been regarded as separate species, interlock with each other. The species concerned are *Myophonus caeruleus* (Scop. ex Sonnerat), for which I fix Canton as its type locality, and *Myophonus eugenei* described by Hume from the lower Irrawaddy (Thayetmyo). The difference between the two forms consists primarily in the following:

	<i>Length of wing</i>	<i>Lower mandible</i>	<i>Rump feathers</i>	<i>Middle wing-coverts</i>	<i>Length of bill</i>
<i>caeruleus</i>	up to 178	black or dusky yellowish	with white shaftline	with white terminal spots	larger in the center
<i>eugenei</i>	up to 184	yellow	without white shaftline	without white terminal spots	narrower in the center

"The more primitive form might be *eugenei*, as its essential characteristics already appear in the juvenal dress, whereas the young *M. caeruleus* still possesses the yellowish lower mandible, entirely black flank-feathers, no white tips on the wing-coverts, and therefore is difficult to distinguish from *eugenei*. In the post-juvenal moult, which takes place in late summer (the remiges and rectrices are not involved), the final coloration is reached in *M. caeruleus*.

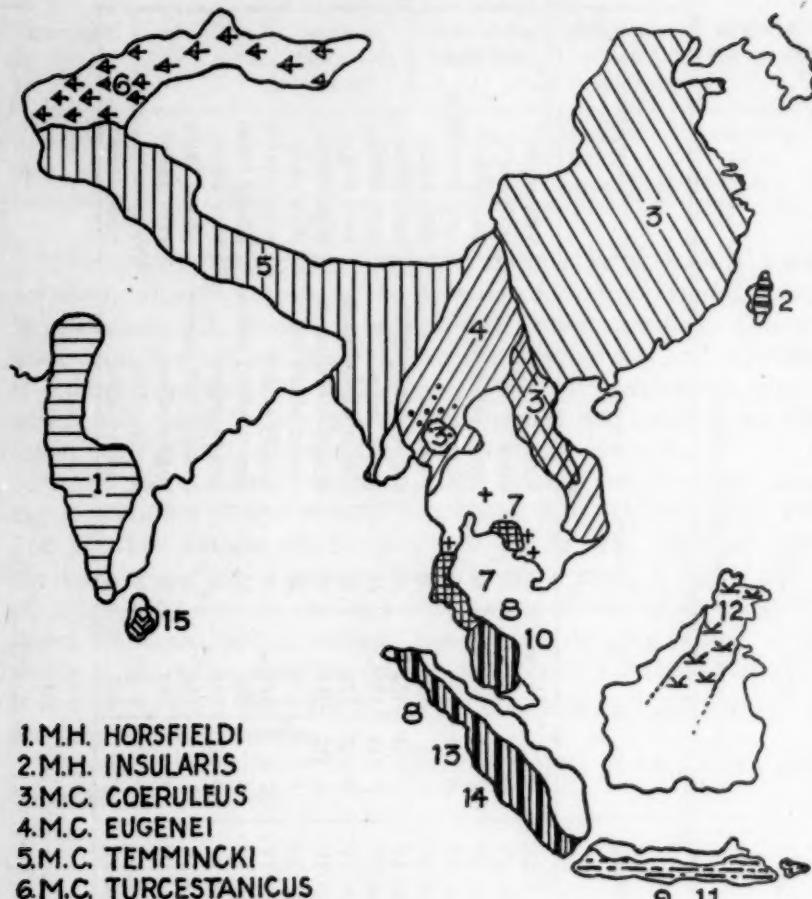
"Seven *M. caeruleus* obtained in the Kwangtung Province, after the post-juvenal moult, measure as follows: wing, 155, 166, 167, 174, 174, 174, 178; culmen, 25, 26, 26, 27, 27, 28, 29 mm. In three cases, the lower mandible is entirely black; in three cases, it shows traces of yellow spots, and in one bird even the tip of the upper mandible shows up much lighter, without, however, being pure yellow. The width of the white shaftline on the flank-feathers varies widely but it is always clearly discernible. The white spots on the wing-coverts are large in all specimens."

The specimens collected by Weigold, with their characteristics, may be tabulated as follows:

SPECIMENS OF *Myiophonus caeruleus*

No.	Locality	Dates	Sexes	Wing	Culmen	Color of bill	Rump feathers	Spot on lesser wing-coverts
1	obh. Wanhsien (C)	5. III	♂	169 mm.	26 mm.	black	very white	large
2	Waschan (W)	29. IV	♂	III	176	black	little white	large
3	"	29. IV	♂	III	172	partly yellowish	very white	large
4	"	30. IV	♂	III	174	black	very little white	small
5	"	28. IV	♀	II	170	black	very white	large
6	"	29. IV	♂	III	172	almost wholly black	very white	medium
7	"	28. IV	♀	III	172	partly yellow	very white	large
8	"	29. IV	♂	III	176	almost wholly black	very white	large
9	"	30. IV	♂	III	177	almost wholly black	little white	large
10	"	28. IV	♂	III	174	almost wholly black	little white	large
11	"	28. IV	♀	III	177	slightly yellow	wholly black	absent
12	"	29. IV	♂	III	184	almost wholly yellow	wholly black	absent
13	"	30. IV	♂	III	173	largely yellow	very white	large
14	"	29. IV	♀	III	164	terminal half yellow	almost black	absent
15	"	30. IV	♂	III	183	largely yellow	very white	large
16	Tatsienlu (T)	1. VI	♂	III	178	wholly yellow	very white	large
17	Atentsze (T)	26. IX	♀	III	164	wholly yellow	wholly black	absent

GENERAL DISTRIBUTION  
OF THE GENUS *MYIOPHONEUS*



- 1. M.H. HORSFIELDI
- 2. M.H. INSULARIS
- 3. M.C. COERULEUS
- 4. M.C. EUGENII
- 5. M.C. TEMMINCKI
- 6. M.C. TURCESTANICUS
- 7. M.C. CRASSIROSTRIS
- 8. M.C. DICRORYHNCHUS
- 9. M.C. FLAVIROSTRIS
- 10. M.C. ROBINSONI
- 11. M.G. GLAUCINUS
- 12. M.G. BORNEENSIS
- 13. M.G. CASTANEUS
- 14. M.G. MELANURUS
- 15. M.H. BLIGHI

• RECORD OF  
M.C. TEMMINCKI  
+ RECORD OF  
M.C. EUGENII

"If the collector had confined himself to preserving only one specimen instead of this instructive series, one probably would have 'identified' Nos. 2-10 as *caeruleus*, Nos. 11, 12, and 14 as *eugenei*, No. 13 as *temminckii*. As it is now, it is shown that a point of contact has been found between *M. c. caeruleus* and *eugenei*, in which both races have hybridized. In this hybrid zone the individuals predominate which possess a more or less intermediate coloration. Presence of the white spots on the wing-coverts is always coupled with white shaftlines on the flank feathers; but the genetic factor, controlling the coloration of the bill, remains independent (compare Nos. 15 and 16 with *eugenei* bill and *caeruleus* plumage). It is probably not a coincidence that the largest individuals (Nos. 12, 15, 16) have the *eugenei* bill.

"The width of the zone of mixture is unknown; undoubtedly Tatsiénlú also comes within its bounds, since Thayer and Bangs mention birds from there with *eugenei* plumage, while Weigold's No. 16 possesses *caeruleus* plumage. *M. c. eugenei* inhabits Yunnan, Burma, Siam and Indochina. It is interesting that also within this territory, in the Karen Hills, occasionally individuals with *caeruleus* plumage are found (so-called '*temminckii*', in reality progressive variations of *eugenei*). Weigold reports that pure *caeruleus caeruleus* occur in eastern Szechuan on the Yangtse in and above Wanhsien on November 5 and March 5 at 185 m. In the boundary mountains of Oméi and Washan and Kwanhsien to Tatsiénlú, mixed forms and hybrids frequently inhabited regions of the wildest torrents, particularly at the edge of waterfalls, at altitudes of 1200-3000 m. In the west, in the Yunnan-Tibet region, some, which undoubtedly were, as the supporting specimen shows, pure *eugenei*, were recorded at five points between Batang and Atentsze at an altitude of 2200-3360 m."

The above conclusions dispose of the objection that *caeruleus* and *eugenei* cannot be conspecific because they breed in the same localities. Their position is the usual one that obtains anywhere on the distributional borders of two races. Farther south, *caeruleus* and *eugenei* occur commonly together during the cold season in the southeast of Yunnan, the northeast and the center of Indochina, and in the northwest of Siam. The differences in the size and the thickness of bill and legs in the two birds are very striking in living specimens and lead one to believe, as I long did, that they represent two separate species. But it is certain that, in all these areas, *caeruleus* is but a winter visitor having been found from October till the beginning of April; it has never been found later in the spring, while *eugenei* is the resident breeding form.

There is an interesting bird in the Museum of Comparative Zoology, a male *caeruleus* taken on Mt. Angka, northwestern Siam, on March 15, 1937, which has no white tips to the median wing-coverts; it has, however, some white on the flank feathers. It is an intermediate between *caeruleus* and *eugenei*, probably a migrant from the mixed area discovered by Weigold.

Curiously enough, and for no apparent reason, both forms of *Myio-*  
*phoneus* are lacking entirely in the high regions of northern Laos and northeastern Siam where a great deal of work has been done lately by collectors, including myself. They have not been found west of the Tonkin border.

In Yunnan, the breeding bird is undoubtedly *eugenei*, which has been found all over the province (Rothschild, 'Avifauna of Yunnan,' Novit. Zool., 33: 256, 1926). In the west, it intergrades with *temmincki* and there is a well-marked hybrid in the American Museum, collected by Forrest on the Lichiang Range, together with several pure *eugenei*. Such perfectly normal intergradation and overlapping take place also along the Irrawaddy, and quite a number of birds presenting the characteristics of *temmincki* have been found east of the river, often a long distance away. Ticehurst (Ibis, 1938, p. 398) lists the following instances in Burma, where both races have been recorded: foothills of the Arrakan Yomas, west of Thayetmyo; Karen Hills; Na Noi, west of Inle Lake, South Shan States; Loi San Pa, Mong Kong State, South Shan States; Htawgaw, Myitkyna Hills.

The case of white-marked birds occurring during the winter on the mountains of eastern Burma, South Shan States and northwestern Siam is more puzzling, but they must be considered at present as migrants wandering far to the southeast during the cold season.

Deignan's name *rileyi* cannot, in my opinion, be accepted for these birds. Of the characters involved in the description to separate it from *temmincki*, the author himself dismisses now those relating to the size and number of the spangles. Furthermore, the ground color of *temmincki*, *eugenei* and *crassirostris* is exactly the same on the abdomen. Normally, it is black in all three, and it only turns brownish in worn plumage, long after the moult. Just as many black-bellied specimens can be found among Malay birds as among Himalayan ones. The only form which is normally browner and duller is *dicrorhynchus*. As to the amount of white on the base and shaft of the feathers of the flanks, abdomen and lower back, it is indeed on the average greater in *crassirostris* than in *temmincki*, but it varies individually in the latter race, and one can match the specimens of '*rileyi*' that I have examined with many Indian and Burmese birds.

I therefore consider these isolated white-marked birds which have been found east of the Irrawaddy as stray and migrating *temmincki*. Near the southeastern limits of its range, one finds a few specimens of *temmincki* which are rather larger and have more white; although their bill is not thicker, they evidently show a tendency toward *crassirostris*. It is an interesting fact in the history of the evolution and distribution of the species that *temmincki* seems to be more closely related to *crassirostris* than is *eugenei*.

### III. *MYIOPHONEUS ROBINSONI*

*Myiophonus robinsoni* Ogilvie-Grant, Bull. British Ornith. Club, 15: 69, 1905: Mt. Mengkuang Lebar, Selangor, Malay States.

*Description*.—Medium size; rather large bill, mostly yellow. Anterior crown slightly lighter blue than the head; bright-blue lesser wing-coverts; upper parts dull blackish blue; breast feathers with blue spangles; abdomen dull brownish black; white on the bases of feathers of abdomen, back and flanks.

Sexes alike, but the female is a little duller and browner below.

*Dimensions*.—Wing, 131–148; tail, 92–103; tarsus, 42–46; culmen, 30–33; depth of bill, 9 mm.

*Distribution*.—Malay Peninsula, only in Selangor, from the Semango Pass to Gunong Mengkuang (at about 5,000 feet).

*Note*.—This very interesting species has potentially the characteristics of all the others. The blue fringes of the breast feathers are distinctly shining and constitute spangles, rather ill-defined, but decidedly different from the silky, but not shining blue fringes of the same feathers in *glaucus*.

### IV. *MYIOPHONEUS GLAUCINUS*

#### 1. *Myiophonus glaucinus glaucinus*

*Pitta glauca* Temminck et Laugier, Pl. Col., 194, 1823: Java.

*Turdus cyaneus* Horsfield (nec Müller, 1776), Trans. Linn. Soc. London, 13: 140, 1821: Java.

*Description*.—Medium size; large black bill. Anterior crown bright blue; head blackish; general plumage dark blue, with bright-blue lesser wing-coverts and wide blue margins to the feathers of the breast; white bases in feathers of the flanks, back, abdomen and lower breast. Female similar to male, but a little duller and with less bright blue on the crown and on the breast. Young brownish black.

*Dimensions*.—Wing, 135–147; tail, 83–92; tarsus, 39–41; culmen, 30–31; depth of bill, 8–9 mm.

*Distribution*.—Java and Bali, above 2,500 feet.

#### 2. *Myiophonus glaucinus borneensis*

*Myiophonus borneensis* H. H. Slater, Ibis, 1885, p. 123: Sarawak, Borneo.

*Description*.—Medium size; large black bill. Male: dark purplish blue, brighter on the head and breast, duller on the back; lesser wing-coverts bright violet blue;

wings and tail black; much white on the base of the flanks, back, breast and abdomen feathers. Female: entirely dark brown, with dark-blue lesser wing-coverts. Young brown, distinctly streaked with white underneath.

*Dimensions*.—Wing, 137–147; tail, 86–103; tarsus, 42–48; culmen, 29–32; depth of bill, 9 mm.

*Distribution*.—Borneo, between 2,000 and 9,000 feet on Kina Balu.

### 3. *Myiophonus glaucinus castaneus*

*Myiophonus castaneus* W. Ramsay, Proc. Zool. Soc., London, 1880, p. 16: West Sumatra.

*Description*.—Medium size; large black bill. Male: anterior crown bright blue; head, neck and breast dark blue, passing to chestnut brown on the abdomen; lesser wing-coverts bright blue; back, wings and tail chestnut; white bases in feathers of flanks, abdomen, breast and back. Female: anterior crown bluish black, passing to blackish brown; lesser wing-coverts blue; rest of plumage chestnut.

*Dimensions*.—Wing, 137–147; tail, 86–103; tarsus, 42–48; culmen, 29–32; depth of bill, 8–9 mm.

*Distribution*.—Sumatra, above 3,000 feet.

## V. MYIOPHONEUS BLIGHI

*Arrenga blighi* Holdsworth, Proc. Zool. Soc., London, 1872, p. 444: Nuwara Eliya, Ceylon.

*Description*.—Size very small; rather large bill, black. Male: head black; general plumage uniform dark blue, with lesser wing-coverts lighter blue, remiges and rectrices black. Female: chestnut brown above, reddish below, with blue lesser wing-coverts and a slight bluish suffusion on the back and wings. Young reddish brown, mottled on head and breast. No white on flank feathers.

*Dimensions*.—Wing, 97–104; tail, 77–86; tarsus, 32–35; culmen, 26–27; depth of bill, 6–7 mm. The smallest species.

*Distribution*.—Ceylon, above 3,000 feet.

## VI. MYIOPHONEUS MELANURUS

*Arrenga melanura* Salvadori, Ann. Mus. Civ. Stor. Nat. Genova, 14: 227, 1879: Padang Highlands, Sumatra.

*Description*.—Small size; short black bill. Anterior crown and supercilium bright shining blue; very bright-blue lesser wing-coverts; back black, with bright-blue spangles; remiges and rectrices black; under parts black, with broad blue terminal spangles to the feathers. No white on the bases of flank feathers. The female is similar to the male, but duller and more brownish below, on wings and tail.

*Dimensions*.—Wing, 122–132; tail, 86–94; tarsus, 37–42; culmen, 24–25; depth of bill, 6 mm.

*Distribution*.—Sumatra, on the mountains, from 4,000 to 9,000 feet.

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## NEW FORMS OF BIRDS FROM MEXICO AND COLOMBIA

BY ALEXANDER WETMORE

THE three forms, whose descriptions follow, have been separated during current work on collections recently received in the U. S. National Museum from the localities concerned.

*Dendrocolaptes certhia hyleorus* subsp. *nova*

*Type*, U. S. National Museum no. 369,011, male, taken at Caracolito, Departamento de Magdalena, Colombia, March 25, 1941, by A. Wetmore and M. A. Carriker, Jr.

*Characters*.—Similar to *Dendrocolaptes certhia puncti-pectus* Phelps and Gilliard (Amer. Mus. Novit., no. 1100, p. 4, December 31, 1940: La Sierra, Río Negro, Perijá District, State of Zulia, Venezuela) but definitely paler both above and below; ground color of lower surface lighter buff; dark markings duller black; indistinct band across breast duller and lighter in color, with the black markings in it less heavy; wings paler, especially at the tips of the primaries; back, hind neck and rump slightly paler; bill broader and heavier.

*Description*.—Crown and upper hind neck varying from dull honey yellow to Isabella color, each feather tipped with dull black and crossed by one or two narrow, slightly semicircular bars of dull black; line from middle of eye back above auricular region more solidly honey yellow forming an indefinite superciliary streak; forehead dark grayish olive with indistinct tippings of dull honey yellow and barrings of black; loral region dull deep grayish olive; side of head dull honey yellow, indistinctly banded with dull black; lower hind neck and upper back olive-brown, with a few scattered, short shaft-markings of honey yellow, and indistinct cross-barrings of black; lower back changing from bister, with more definite black bars, to russet, unmarked, on the rump and upper tail-coverts; scapulars bister; lesser and middle wing-coverts sepia, with indefinite shaft-markings and terminal spottings of honey yellow, incomplete semicircular barring and occasional irregular shaft-streakings of dull black; greater coverts with external webs sepia, and internal webs verona brown, the inner ones with an indistinct subterminal spot of black, followed by an equally indefinite spot of honey yellow; primaries and secondaries between russet and Mars brown, the primaries edged externally with sepia, becoming bister at tips; rectrices carob brown; throat deep olive-buff, with the feathers margined narrowly on sides and tip with dull black, and with irregularly outlined sub-basal, more or less U-shaped markings of dull black; fore neck changing to a somewhat brighter tone with the black markings much heavier and more prominent; upper breast with light markings dull chamois, the black markings heavier and the feathers edged broadly enough with light brownish olive to produce the appearance of an indefinite, fairly wide cross-band; lower breast dull chamois barred narrowly with dull black, becoming lighter, duller cream-buff on abdomen, and deepening again to chamois on under tail-coverts, the black bars continuing as above; outer under wing-coverts chamois, inner ones honey yellow, all barred with dull black; inner webs of inner primaries and secondaries sayal brown. Bill dull black, becoming fuscous at base; tarsus and toes hair brown; claws black (from dried skin).

**Measurements.**—One male (the type): wing, 132.8 mm.; tail, 109.9; culmen from base, 40.3; tarsus, 38.8. One female: wing, 127.8 mm.; tail, 118; culmen from base, 39.3; tarsus, 27.9.

**Range.**—Known from the valley of the Río Ariguani near Caracolito, Departamento de Magdalena, Colombia.

**Remarks.**—The two specimens on which this form is based stand out at a glance from a considerable series of *D. c. sancti-thomae* because of the breast-band. In this the new form is like *D. c. puncti-pectus* of Venezuela, found along the eastern base of the Perijá range. I have made comparison with the type of *puncti-pectus* in the American Museum of Natural History to find, as indicated in the diagnosis above, that the two groups are quite distinct in depth of color, as would be expected from their separation by the intervening mountain range.

It is probable that *D. c. hyleorus* occupies the area lying between the Río Magdalena and the mountains to the east, south into Santander.

**Xiphorhynchus flavigaster saltuarius** subsp. nova

**Type,** male, U. S. National Museum no. 135,161, from Altamira, Tamaulipas, México, taken November 19, 1894, by F. B. Armstrong (purchased from W. F. Webb).

**Characters.**—Similar to *Xiphorhynchus flavigaster eburneirostris* (Des Murs) (*Dryocopus eburneirostris* Des Murs, Icon. Ornith., livr. 9, pl. 52, with text, July, 1847; Realejo, Nicaragua) but paler, especially on the posterior region of the ventral surface; streaking below less sharply defined; light streaks on back much larger and more prominent.

**Description.**—Crown and hind neck dull black, each feather with the broad, elongated center cream-buff, producing a spotted appearance; the light markings above the eye becoming olive-buff, making a poorly defined superciliary streak; area in front of the eye, continuing back beneath eye over side of head, deep olive-buff, streaked more or less with dull black, these black markings heaviest in a line behind the eye; feathers of lower hind neck and upper back with broad central streaks of grayish cream-buff bordered by a narrow line of black, with an external margin of light brownish olive; on scapular area the light streaks becoming chamois externally, with the black bordering line heavier, and the outer margin Dresden brown; lower back changing to sayal brown, with indefinite indication of slightly brighter central streaks; rump slightly brighter than sayal brown; upper tail-coverts Mikado brown; external rectrices russet, central ones slightly darker; lesser wing-coverts clay color, with scanty, obscure spotings of cinnamon; middle and greater coverts Saccardo's umber, with faintly indicated central streaks of cream-buff, bordered with dull black; primary coverts snuff brown becoming Mikado brown internally; primaries and secondaries russet, the tips of the primaries becoming hair brown on the inner web; chin whitish; throat cream-buff, the lateral posterior feathers with a narrow lateral margin of dull black on the external side; general tone of under surface grayish olive to deep grayish olive, the feathers of the breast streaked broadly but obscurely with olive-buff, with indefinite bordering lines of grayish black; sides and flanks light hair brown to drab; under tail-coverts drab, streaked with olive-buff with an external margin of blackish bordering the

light streaks; under wing-coverts cinnamon-buff; edge of wing Saccardo's umber, lined with cream-buff; inner webs of primaries and secondaries cinnamon, except for the tips of the outer primaries, which, as indicated, are hair brown. Bill hair brown on sides, drab on basal half of culmen and gonyx, and deep olive-buff at tip; tarsus and toes fuscous (from dried skin).

*Measurements.*—Nine males: wing, 109–120 (115) mm.; tail, 93–106 (100.4); culmen from base, 40.4–44.9 (42); tarsus, 21.8–23.8 (22.9).

Three females: wing, 105–112 (109) mm.; tail, 88–100 (96); culmen from base, 39.8–44.0 (42.1); tarsus, 21.8–22.3 (22).

Type, male: wing, 117 mm.; tail, 100.2; culmen from base, 41.1; tarsus, 23.4.

*Range.*—Southern Tamaulipas (Altamira) to northern Veracruz.

*Remarks.*—The present form, definitely different in the characters indicated, marks the northern extremity of the species in northeastern México. Intergradation apparently comes to the north of the latitude of Vera Cruz City. Two specimens from Orizaba are definitely intermediate, combining the darker coloration of the more southern of the two forms under discussion with a tendency toward the more prominent light dorsal markings of the more northern one.

In explanation of the use of the subspecific name *eburneirostris* in the diagnosis above, van Rossem (Proc. Biol. Soc. Washington, 52: 15, February 4, 1939) reports that he has found that the type of *flavigaster* Swainson, long accepted for the bird ranging from northeastern Mexico south into Central America, is an example of the race currently recognized as *X. f. megarhynchus* Nelson. The term *flavigaster* is thus transferred to the subspecies named by Nelson, leaving *eburneirostris* as the next available name for the other form mentioned.

*Empidonax flavescens imperturbatus* subsp. *nova*

Type, U. S. National Museum no. 359,904, male, gonads enlarged, taken at 3000 feet elevation on Volcán San Martín, Sierra de Tuxtla, Veracruz, México, April 16, 1940, by M. A. Carriker, Jr.

*Characters.*—Similar to *Empidonax flavescens dwighti* van Rossem (Auk, 45: 359, 1928: Los Esesmiles, Chalatenango, El Salvador) but duller and darker; abdomen lighter yellow; throat and breast-band duller gray; upper surface duller, less yellowish green; edgings on wing- and tail-feathers lighter, less clearly green.

*Description.*—Entire dorsal surface dark citrine, with faint edgings of citrine on the forward part of the crown, producing a slightly dappled appearance, the short feathers over the nostrils sulphine yellow; sides of head and sides of neck dull citrine; eye-ring primrose yellow, narrowed decidedly for a small segment on the upper margin; an indistinct mark of dull primrose yellow over the ear-coverts; remiges and greater middle wing-coverts chaetura black, the two series of coverts tipped with chamois to form two well-marked bars; primaries with a very narrow margin of dark olive-buff; secondaries and tertials with a slightly wider edging somewhat lighter than chamois; edge of wing changing from colonial buff at end to chamois mixed with light yellowish olive toward joint; axillars and inner under wing-coverts Marguerite yellow; outer under wing-coverts chaetura drab, edged

with deep olive-buff; rectrices slightly lighter than chaetura drab (apparently somewhat faded by wear), with an outer edging of buffy citrine that becomes broader toward base; center of throat and fore neck with feathers basally Marguerite yellow, overlain toward the side with light yellowish olive; breast light yellowish olive with very faint and indistinct edgings of olive-yellow; abdomen dull citron yellow; flanks dull citrine; under tail-coverts reed yellow. Maxilla black, mandible flesh color, tarsus and feet leaden (from collector's notes on label).

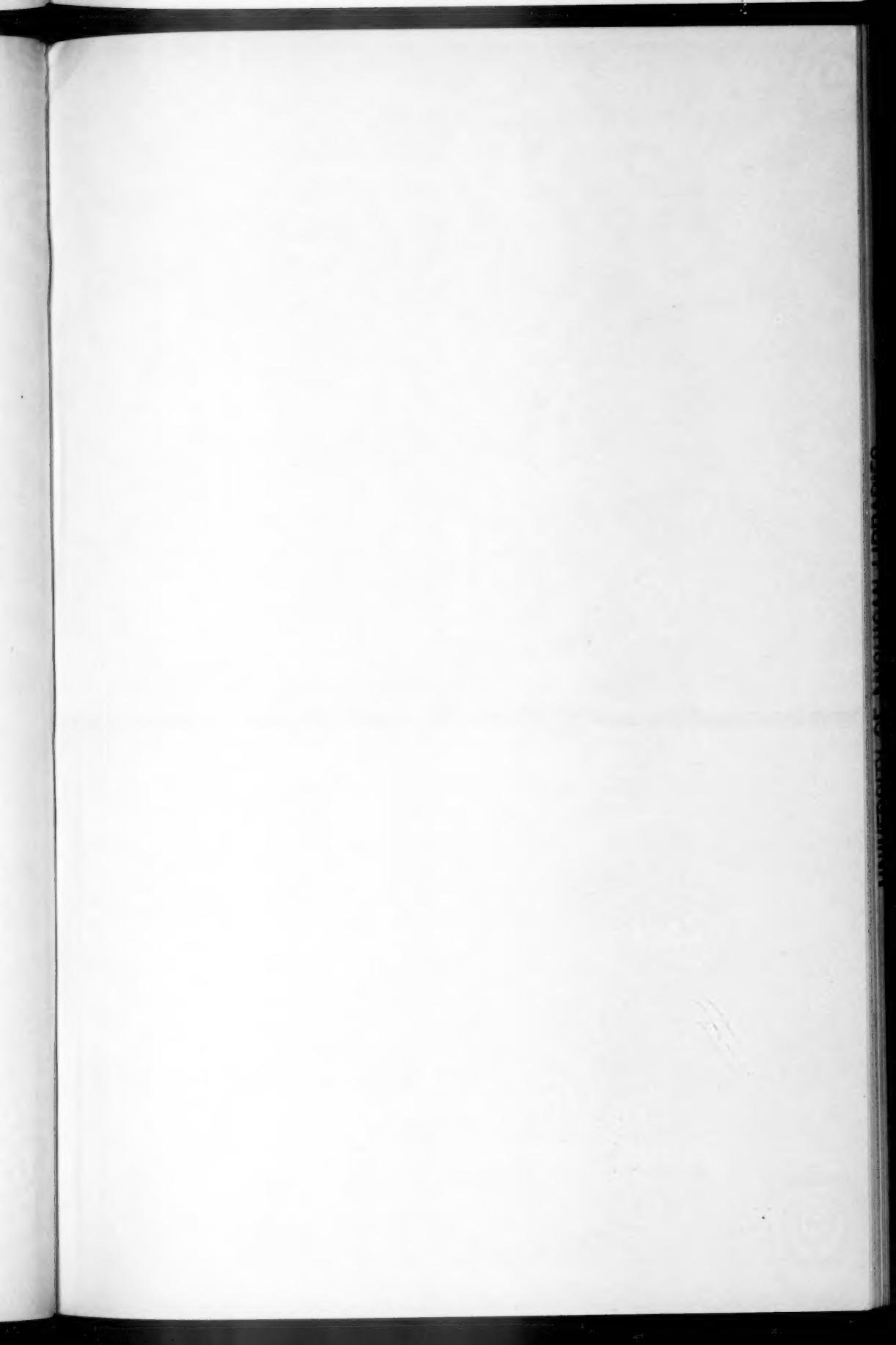
**Measurements.**—Males, two specimens: wing, 69.9–72.2 mm. (type); tail, 56.5–57.5 (type); culmen from base, 13.5 (type); tarsus, 16.6–16.7 (type).

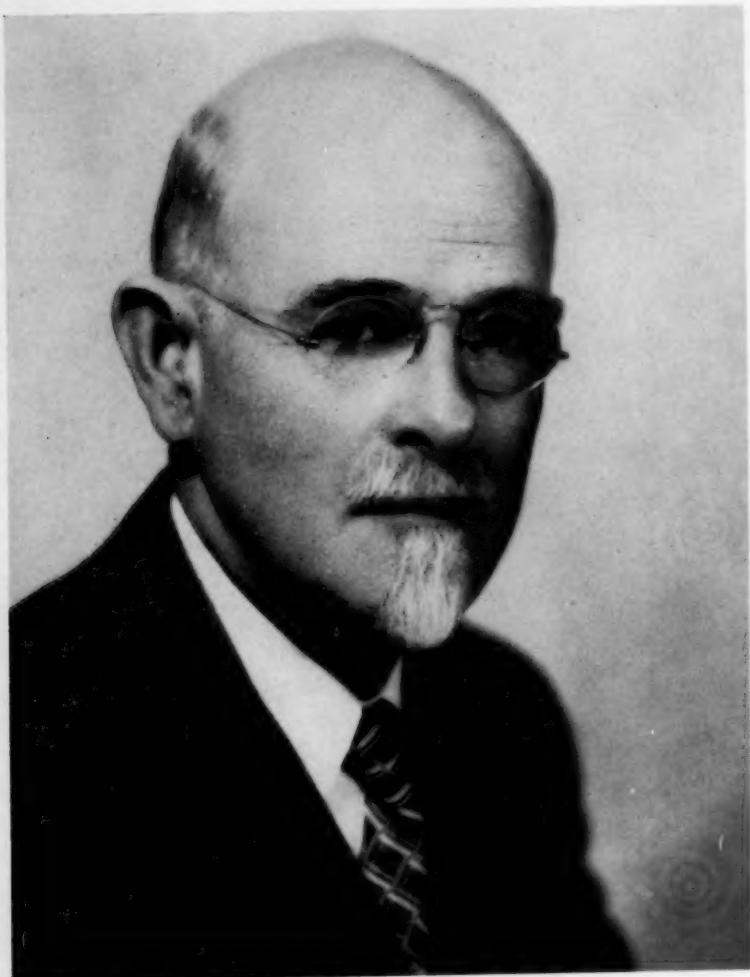
Females, two specimens: wing, 62.8–63.7 mm.; tail, 51.1–52.4; culmen from base, 12.3–12.7; tarsus, 16.1–16.2.

**Range.**—Known only on Volcán San Martín, Sierra de Tuxtla, Veracruz, where it is found from 3000 feet elevation across the summit.

**Remarks.**—The present form marks a considerable extension in range for the species which heretofore has been known only north into Chiapas. Carriker found these birds fairly common in the higher forests on San Martín, and collected four specimens. The differences that these offer from *E. f. dwighti*, the nearest form, which I have seen in life in the mountains of Guatemala, are easily evident. It is probable that the race occurs also on the other of the main peaks in this mountain range, the Cerro de Tuxtla.

*Smithsonian Institution, Washington, D. C.*





Yours,  
Joseph Grinnell

## IN MEMORIAM: JOSEPH GRINNELL

BY JEAN M. LINDSAY

*Plate 9*

ORNITHOLOGY is essentially a study for amateurs, despite the widespread recent tendency to pursue it as a profession. Joseph Grinnell, one of the foremost of American amateurs, took a large part in bringing the study of birds to the level of importance such that many people thought of it as a prospective profession. It may yet turn out that he, of all ornithologists active in America in the first half of this century, exerted the greatest influence upon his fellow workers. It is partly in this light that we examine the activities and accomplishments of this man.

His ancestry and early life have been traced in authoritative detail by Mrs. Grinnell in the biography which appeared with a bibliography of his writings in 'The Condor' (42: 1-34, 1940). Both grandfathers were Quaker ministers, and they were members of families which came early from France and England to the New England of three centuries ago. Thus it was no great surprise to see expressed in Joseph Grinnell many of those traits which we expect in a resident of that section of the country.

After the birth of Joseph on February 27, 1877, in Indian Territory, the Grinnell family lived for brief periods at several widely separated places before coming to California to settle at Pasadena. His father's medical profession and his mother's interest in literary accomplishment provided likely incentive and solicitous encouragement for those leanings toward natural history already aroused by Joseph's early experiences on the frontier. His schooling through the college at Throop Polytechnic Institute was completed at Pasadena with only one two-year interruption when the family moved back to Carlisle, Pennsylvania.

Thirty-two years after his graduation from Pasadena High School he recalled that the University of all California, in his school days, was Stanford; and Jordan was synonymous with Stanford. As far as he could recall, at that time he had barely heard of Berkeley. His story, written for a brief talk, but never printed, continues:

"Toward graduation time, in the spring of 1893, there was much talk, both at home and at school, of Stanfurd. In the fall, four out of my class of 16 left for Stanford. I think only one out of the class went to some other university. But my age was 16, bulk small, trousers short, and those about me were obsessed with the idea that

I was distinctly too infantile to be permitted away from home. Perhaps so; at any rate, I had to be content with spending four years of so-called college tuition at the local Polytechnic Institute. With an A.B. from there, and after returning from a year and a half of adventure in Alaska, it was finally decided that I could be trusted to attend a real university; and in the middle of the spring semester of 1900 I reached Stanford, with certain personal handicaps which must have been distressingly outstanding, not only to my new instructors but to my fellow students at the tables in the zoology laboratory. I can recall with some clearness that one of the latter, Cloudsley Rutter, told me so!"

The trips to Alaska no doubt served better than could an equal amount of school to prepare Joe Grinnell for his future. Naturally they were not the well-scheduled routines of more recent, agency-conducted excursions. But the very uncertainties made these expeditions valuable for the bird collector. He could be most active when the normal program was most broken and uncertain. The first trip, in 1896, was made possible by the invitation of Captain Richard Henry Pratt, an official acquaintance of the family. As soon as Joe reached Alaska, he was determined to stay as long as possible. Besides some practice with meager subsistence and many unfamiliar situations, he was able to accumulate much new and exciting material for later study, and to encounter several new naturalist-friends. One of these, Mr. Joseph Mailliard, in autobiographical notes in 'The Condor,' later expressed his version of this new acquaintance in these words: "At that time, Grinnell struck me as being a bright, intelligent, and enterprising 'kid'—a bit 'fresh' perhaps—with lots of energy and possibilities. The tendency to 'freshness' soon fell away with maturing years, but time has proved the remainder of my diagnosis to have been correct, as all readers of 'The Condor,' and many others, know."

This trip turned out so well that in two years it was easy to get parental sponsorship in joining a group of twenty-two Alaska-bound, prospective gold miners. The group outfitted their own boat, and camp for the winter was established on the Kowak River. Although Joseph's membership in the company involved certain duties and responsibilities, abundant time remained for collecting birds and recording their activities in the region. Volunteer help, especially from Dr. William V. Coffin, made it possible to obtain and save an extra amount of material in the short rush season when it was most easily available. About seven hundred bird skins and as many eggs were preserved. The materials from the two trips extended Grinnell's scope of interest in bird systematics, provided adequate basis for an

imposing series of reports, and brought his work immediately and favorably to the attention of older ornithologists at eastern museums. His reputation as an alert yet careful worker grew rapidly in this period.

It was a fortunate circumstance, possibly, that Grinnell grew up in the far West where he was comparatively free to work out and develop his own type of approach to the bird problems presented by the region. In his early years nearly all of the bird work in this country, even that which concerned the West, was done by persons who lived along the Atlantic coast. He was not alone, however, in developing his bird studies, for there were many young Californians his own age or older who provided help, companionship, competition, and contagious enthusiasm, all important elements in the growth of an active naturalist. These made up for the lack of large museums, and each naturalist was thus encouraged to make his own museum.

Joseph's collection was begun before he was thirteen; the first specimen was a toad obtained in his last stay at Carlisle. His permanent catalogue, begun in 1894 (on January 1) when he was seventeen, started with specimen number 72, the skin of a Red-shafted Flicker. He had destroyed all specimens made earlier. By the time he entered Stanford University for graduate work, he had assembled nearly 4500 bird skins. Even at this early stage Grinnell's impressive ardor in the field was prophetic of the proficiency which made his expeditions so effective. He was impatient to start each trip. His headquarters in the field were not the nearest hotel, but a sequestered spot where he could set up his own tent, live with the simplest equipment and be able to get the full worth of out-door surroundings. Grinnell could be at the same time a strict adherent to custom and a zealous advocate of change. Thus he clung to simple, commonplace procedures and utensils in camp and in the handling of specimens, but he seemed to practice most unorthodox schemes for detecting animals and interpreting their lives. Possibly this was mainly the result of his increasing application to the problems and his continuously inquisitive thinking of them. He seemed to meet each individual animal as though he were encountering the species for the first time. His work in the field combined this restless enquiry with tireless physical activity. No question of enduring possible hardship occurred; he did not even recognize them. Rain, snow, cold, heat, dust, insects, mud, or wind might plague other workers to the point of inactivity, but Grinnell derived special pleasure in pretending not to be hindered by them, and thus he was able to overcome

the inconvenience. A few naturalists have traveled more miles in California than did Grinnell, but certainly none has gained so extensive a first-hand knowledge of its birds and mammals and of certain phases of its vegetation. His early trips on foot and by wagon or pack outfit were long and thorough. Later ones by automobile were shorter, but they served to fill gaps and to extend a vast experience with the animals and their environment.

Joseph Grinnell in many ways exemplified the truth of the conclusion that persons who achieve greatly are characterized not only by superior intellectual ability but also by persistence of motive and effort, confidence in their abilities, and great strength or force of character. These traits made the results of favorable turns of chance always appear doubly impressive in his achievement. Ordinary persons had little prospect of keeping up with his rate of progress, and he had little need to be concerned over their possible encroachment upon his domain.

In its early years, the Cooper Ornithological Club published minutes of meetings in the 'Nidiologist.' In the report on the meeting at San Jose on January 6, 1894, is the announcement that "Jos. Grinnel" of Pasadena was elected to membership. At the April meeting, two skins of Pygmy Owls sent in by Mr. Grinnell from Pasadena were exhibited. Further evidence of ornithological activity in southern California came soon, for in the minutes of the December meeting is the announcement that "an Annex to the Club has been organized, the principal place of meeting being at Pasadena. It is intended for the benefit of Southern Californian members. The following officers of the Annex were elected: president, Ralph Arnold; vice-president, Jos. Grinnell; secretary-treasurer, H. A. Gaylord. It was decided to begin a club collection of specimens, for which space has been secured in the Throop Polytechnic Institute." As another item of business at this first meeting "a proposition to publish a list of Southern California birds was made by Mr. Grinnell. It was decided to call for notes from all Ornithologists." Grinnell made still further contribution to this first meeting by reading a paper, on sap-suckers.

In subsequent years, as many persons became devoted to the welfare of this bird club and pooled their ingenuities to keep it going, the necessity for some means of unifying its scattered membership and keeping it one organization became more and more evident. Whether he or the Club recognized the need or not, Grinnell seemed to be the person who contributed most to this unity and continuity. His alternating residence with northern and southern divisions at a

critical period made it possible for each to accept him as one of its own members. The Club supported 'The Condor,' 'The Condor' maintained the Club, and Joseph Grinnell sustained 'The Condor.'

After the first period when Chester Barlow was the Club, according to common testimony of its early members, the affairs of the journal were cared for by Walter K. Fisher, with Grinnell as an active apprentice. In 1906 Grinnell became Editor. Possibly his greatest gift to the venture was the talent for withholding his own personality until it was needed. In any undertaking of the group others came first, but he was always prepared to offer suggestions or to perform any chore. His explanation for taking initiative was that someone had to do it, but he knew also that the most certain way to strangle group endeavor would be to hinder the enterprise of others.

The facilities of contributors to the magazine and the desires of its subscribers required that continuous attention be given to its future. The numerous articles in it which now make pleasant or profitable reading did not come, ordinarily, without much urge and planning on the part of the Editor. He not only supplied this encouragement as needed, but he repeatedly joined forces with the business managers of the Club. The skill of these officers was just as important as his own, and he was eager always to acknowledge debt to them. By this ideal organization much could be accomplished for bird study, with meager resources.

Besides numerous articles of his own in 'The Condor,' Grinnell was author of eight of the first twenty-six numbers of the 'Pacific Coast Avifauna,' and he edited most of the reports in the series. He contributed further to the interests of bird students by a long series of reviews for 'The Condor' and by writing numerous items of news or other editorial comment, some of which stirred lively reader-interest. These were prepared often on the occasion of some spirited debate, impetuous enquiry, jubilant discovery, or caustic comment by some worker. Anticipation of these provocative opinions made many 'Condor' readers turn first to its editorial page. Other editorial duties performed for the University of California Press, including part of its zoology series, and for the California Academy of Sciences, extended this type of service to a larger circle of workers. For years he offered special instruction at the University to persons preparing to publish concerning discoveries in natural history.

In his first years of bird study Joseph received help from other young naturalists in addition to encouragement from his parents and certain other adults. Dr. Hiram A. Reid singled him out for special mention by including with comment in his 'History of Pasadena' a

list of birds prepared by Grinnell. Two publications helpful to the ornithologist of half a century ago, as they would be at any time, were Coues's 'Key' which came as a Christmas present in 1893 and the magazine, 'The Oölogist,' which provided news and inspiration to all collectors of that time; the study of birds in the 'nineties meant the collecting of eggs and sometimes of skins. In this journal was printed Grinnell's second article, a notice of the Virginia Rail in California.

Membership as an Associate in the American Ornithologists' Union came in 1894, at the twelfth congress. At this time Elliott Coues was President, William Brewster and C. Hart Merriam, Vice-presidents, John H. Sage, Secretary, and William Dutcher, Treasurer. Other members of the Council were J. A. Allen, C. F. Batchelder, Frank M. Chapman, Charles B. Cory, D. G. Elliot, Robert Ridgway, and Leonhard Stejneger. Each of these leaders held the respect of our neophyte and some of them pointed the way by example for most of the work he later undertook. Grinnell's first communication to 'The Auk' appeared in 1897. Scarcely a year passed after that without an article from him or some notice of him or his work in this journal.

It was with unconcealed pride that announcement was made in 'The Condor' when Grinnell was elected to the class of Fellows in the A. O. U. in 1901 when he was twenty-four years old; he was thus the youngest member to receive such distinction. The difficulty of attending the meetings no doubt postponed his taking a prominent part in affairs of the Union. Nevertheless, he made up for this during his term as President (1929-1932) when he gave much thought and active ministration to the Union's problems. His contribution to this organization consisted mainly in supplying information, not always accepted, for the official check-lists, the bringing of representation, in official circles, from the West, and the emphasis of his repeatedly advocated thesis that young persons should have a part in management, even at the risk of bringing rapid changes in custom.

Also early in 1894, Joseph Grinnell began the long series of notebooks which he was to continue through his whole life and where the most important results of his work were to be recorded. Thus, in his seventeenth year the hobby of bird study changed quickly to a full-time undertaking in which all his talents and abilities were applied with marvelous effectiveness right from the first. From this time there could be no doubt about how Grinnell would respond to opportunity, but as yet there was no way to see how the opportunities would come. His concern, however, was for the fulfillment of

an immediate objective, the publication of a list of birds of his home area, the Pacific Slope of Los Angeles County. The appearance of this publication early in 1898 was an important event. The enthusiasm with which it was received and used by bird students no doubt determined the major trends of all its author's future bird work. He had demonstrated that he could complete a task involving the cooperative effort of many persons and at the same time make his own part in it the greatest. He had already demonstrated the knack of getting the results of his studies into print and ready for immediate use by others.

In a declaration of regards to Doctor Gilbert and Professor Price, prepared for the occasion of their retirement in 1925, Professor Grinnell spoke of his early training and of his great debt to those men. His own words are significant and authoritative as explaining some of the outstanding traits of his career. They also illustrate his own distinctive manner of expression. He wrote: "The course that I remember above any other, entered that first fragment of a semester, was Professor Price's course in embryology. I had had a bit of the subject before, but on no such standard of thoroughness as I now found; and I know I benefited markedly. I liked the subject; and Professor Price, in his usual thoughtful fashion, was good enough to remit some of the regular class routine in my case, in lieu of which I was to do a special problem. I studied developing feathers; and to this day, in my teaching, I dwell on that subject, of feather 'anlagen,' with a satisfying feeling of familiarity and authority."

"Under Professor Price, both at Stanford and Pacific Grove, I had a period of training in laboratory technique and in teaching such as I never had before or since. Technique included practice in several of the then rather new methods of cytological preparation, staining, serial sectioning, and reconstruction—involving slow, careful, methodical procedure. The practice I had in preparing chick slides in quantity for class use certainly brought more benefit out of that course, to me as an assistant, than any registered student got by merely studying the slides furnished him ready for examination.

"Then there was the constant example before me of a real teacher, equally methodical in this function as in research, above all, clear and simple in his explanations. In my own teaching in subsequent years, I have again and again found myself not only recalling but using Professor Price's teaching methods, and even adopting his modes of expression. The most practical instruction in teaching I ever had, I thus received from Professor Price.

"The following fall, I had a better start in getting into the swing

of the work in the Zoology Department at Stanford. It was then that I entered Doctor Gilbert's seminar, having been admitted by that time to full graduate standing. That seminar, attended continuously for that and the following two years, served for me as the most disciplined mental training of my student experience anywhere. Indeed, I can say, with confidence of its truth, that of all seminars I have participated in or visited to this day, Dr. Gilbert's was by all odds the most ideally conducted.

"I was at that time enthusiastically ambitious to launch into a research career. But there is testimony on record to the effect that I was rather superficial in my aims and mode of dealing with the problem I had undertaken; that, while I had plenty of initiative perhaps, I was inclined to be slap-dash. Indeed, the words 'cock-sure' and 'fresh,' with zoological connotation, were applied to my style of mental attitude and accomplishment. Dr. Gilbert's seminar proved a helpful antidote to those tendencies. While not conclusively effective, at least said tendencies were undoubtedly retarded, and I believe and hereby acknowledge that my prospects for research were immeasurably improved.

"One more point for comment may be appropriate to mention here. I do not recall having heard either Doctor Gilbert or Professor Price ever speak definitely upon the subject, but I learned by their example to abhor undue publicity. I retain to this day, and probably always will retain, a distaste for personal advertising, not only on the part of others but of myself. I know that it is current practice to carry the 'psychology of salesmanship,' as a current phrase has it, into education and even into the promulgation of science especially where the financial interests of a research institution are concerned. This is probably justified. But that the practice can be extended, on good ethical grounds, intentionally, to the career of an individual I cannot bring myself to grant. No doubt my conscience on this score now would have been decidedly less sensitive if I had *not* been a zoology major at Stanford."

This notion persisted, though it required constant vigilance to forestall the advances of certain resourceful reporters who understood the appeal of nature topics. Grinnell did not approve the sending out of elaborate notices of work to be undertaken or in progress, but when the work was completed and in print, he made effort to see that all persons seriously interested could get copies. He regularly refused to attend or give talks at meetings where the concern with animals was only casual or secondary, though he recognized a need for such work on occasion and encouraged others to engage in it.

Back at Pasadena, in 1903, after the sojourn at Stanford, Grinnell became an instructor and then Professor at Throop Polytechnic Institute. Activities in the field were resumed with more purpose than ever and several students were enlisted with such stimulative fervor that they became naturalists for life, and for long periods their association with Grinnell was continued. One of these students, Hilda Wood, during the school year 1905-06, made a special study of the 500 specimens of reptiles assembled in the previous three years from Los Angeles County. This material was the basis for Bulletin Number 1 in the science series of the Throop Institute. Hilda Wood continued to be Joseph Grinnell's most important helper. On June 22, 1906, in Glendora, they were married, and immediately they set out to continue in the field work already started in the San Bernardino Mountains.

Two years later the family home was moved to Berkeley, where the four children, Willard Fordyce, Stuart Wood, Mary Elizabeth, and Richard Austin grew, each to develop some special aptitude for interest in Nature. Mrs. Grinnell not only conducted important studies of her own in zoology, but she came to have so great a share in her husband's career as actually to share it jointly. The responsibilities she assumed were often essential to his progress.

A major accomplishment was the carrying out over a period of more than forty years, along with a continuously expanding field of activity, the program of study conceived and organized by a boy still in his 'teens. The prospectus, on page 83 of 'The Condor' for May, 1901, for prolonged study of bird occurrence in an area not only lays out unassumingly and uncontestedly a plan so inclusive and so flexible as to meet all developments in the life span of its originator, but it remains still a plan worthy of the best efforts of any naturalist. Other State lists had been and have been assembled, but none with greater thoroughness of preparation or with greater dependence on sound biological study, for the California list involved in striking amount the recognition and application of the general principles involved in the derivation and interrelations of the most nearly tangible units of the evolutionary system, the subspecies. In this region significant materials in large amount and of easy access invite attention and study. Joseph Grinnell's eager enthusiasm in other, more commonplace regions might have become dulled and turned into more exciting endeavors, but not in western North America where every mountain range and valley provokes new interest and effort on the part of the naturalist.

The ingenious plan for recording items in the synonymy and

bibliography made it possible to continue the compilation along with other duties, to carry the whole set of material from one library to another, and to use the information with minimum effort. These factors, then, made it possible to bring to published form the important content of the nearly seven thousand articles referring to birds in California and to keep the analysis up to date. The plan is marvelous for its effectiveness, and it was remarkable that other persons failed to use it in similar situations. As the annotated avian bibliography was made available to other workers in three conveniently usable sections, the accompanying synonymies provided the basis for exhaustive distributional summations of amphibians and reptiles, birds, and mammals in California, and of the birds in Lower California. Except for the list of amphibians and reptiles, these were prepared practically single-handed. For originality, adherence to one objective, completeness, and accuracy the last-named report probably will stand for a long time as an exemplary study of avian geography worthy to be followed. With all its completeness this library work was only a minor part of Grinnell's program. In building the distributional works it became necessary first to do a vast amount of analysis of variation in specimens. This would have led naturally to the preparation of systematic monographs, and he became familiar with the characters and history of nearly every variable species of western bird and mammal, but he left the extensive reports mainly to associated workers. An exception was the revision of kangaroo rats published in 1922. Two highly variable groups, the song sparrows and pocket gophers, attracted his attention, and Grinnell often dreamed of the time to come when he could spend all his time collecting and studying these animals. He made much progress in each endeavor, but was never able to devote the desired application to them. Materials for this work he accumulated, first in his own private collection and later in the museum.

A second major phase of his studies involved the preparation of monographic treatments of areas—no doubt a most effective way of preserving and presenting results of field surveys in natural history. The aim was much like that represented in countless annotated lists, but by the concentration of enormous effort the results became more permanently significant. They represented the combined activities of many persons in the field and indoors. Areas so treated in California include San Bernardino Mountains (1908), San Jacinto Mountains (1913), Lower Colorado Valley (1914), Yosemite (1924), Lassen Peak (1930), and Point Lobos (1936). Of these, the account of mammals and birds of the Lower Colorado Valley, prepared as a

graduate thesis and presented in 1913 at Stanford University, for the degree of Doctor of Philosophy, was probably his most important publication. The volume on 'Animal Life in the Yosemite' was most widely read and it contained much information not strictly dependent on the locality treated.

Another related undertaking was the assembly of monographs to include all that could be learned concerning certain groups of animals in California. The book on the 'Game Birds of California' (1919) and the two volumes on the 'Fur-bearing Mammals of California' (1937) required long preparation and they brought together for those types of animals much information on the natural history, systematic status, and relations to man which could not have been assembled at any other time. In fact, a great deal of it could not now be obtained from the original sources, so quickly and so imperceptibly do conditions change. But Joseph Grinnell knew the necessity for recording history as it is being made and he knew how to make and preserve those records.

The outstanding, conspicuous examples mentioned are but samples of permanent results achieved through the irrepressible pursuit of a problem—the analysis of avian distribution in California. It was characteristic not to plan too definitely, but to be able to take advantage of whatever opportunity came his way and to accept and be unhindered by whatever obstacle might be encountered. Thus it was necessary always to keep the plan of work adaptable. Not many of the projects outlined for study within the general program adopted were completed in the form at first anticipated, but regularly they were completed, usually without loss from the modification. Time after time a study was finished by a group of persons different from the one that undertook it. In each instance, however, Joseph Grinnell provided the greatest share of the enthusiasm and energy which brought the task to completion.

Writing was a difficult task for Dr. Grinnell, but he was nearly always at it. Whether for publication, or as a part of the permanent record to be preserved in the museum, or one of a host of letters, his best effort went into the preparation of anything he wrote. Among other qualities aimed for in his writing, he exercised special effort to make it factual, precise, and varied in expression. Many of his associates marveled at the extent of his vocabulary. He was deliberate and careful in the selection of just the right terms to express the desired meaning. He cultivated discerning powers of analysis and admired exact expression, well-weighed statement. Always he entered

upon any piece of writing with lively anticipation of the result likely to be obtained.

Persons familiar with the work of William Leon Dawson will appreciate his evaluation of Grinnell's writing, expressed in a review: "This San Jacinto bird-book, as it deserves to be called, is a mine of information for the bird student, from whatever angle it is viewed. It is so good, that one who loves *birds* better than he does bird-skins cannot help wishing that half as many bird-skins might have served these insatiable scientists, so that there would have been time left to observe and to record more life-histories. It is not enough to say, 'Let others do that,' for there are not in the West two other more gifted observers of birds than Messrs. Swarth and Grinnell. Of Mr. Grinnell, especially, I cannot forbear to say that some of his recent biographical sketches evince a keenness of insight, and bring out a wealth of first-hand information which mark him as potentially the foremost biographer of Western birds."

Casual examination of the works mentioned above might lead to the hasty conclusion that they resulted from industrious application of a routine sort with a lesser amount of originality. A closer appraisal would dispel this notion, but if any traces of it remained, they would be cancelled by familiarity with some of the essays prepared by Grinnell in the span of his studies. The chronological listing of a few of these shows the trend and scope of his thought as applied to some specially attractive problems, as follows: methods and uses of a research museum (1910), barriers to distribution as regards birds and mammals (1914), conserve the collector (1915), field tests of theories concerning distributional control (1917), sequestration notes (1920), principle of rapid peering in birds (1921), museum conscience (1922), rôle of the "accidental" (1922), trend of avian population in California (1922), burrowing rodents of California as agents in soil formation (1923), conservationists' creed as to wildlife administration (1925), geography and evolution in the pocket gopher (1926), tree surgery and the birds (1927), presence and absence of animals (1928), revised life-zone map of California (1935), and up-hill planters (1936).

Resourcefulness in getting his work published was an important part of procedure in the continuous progress of Grinnell's study. He developed an extensive acquaintance with the possible ways to get into available form the monographic, and therefore useful, reports prepared by himself and others. His opinion as to the proper time to offer a manuscript and the prospects for its acceptance was nearly always right. Moreover, much of his energy went into the provision

of new means of publishing natural history. His own work appeared many times as number 1 in a series.

Grinnell came to occupy a special place which made his influence greatly more effective in affairs of naturalists than could have been possible under other circumstances. He was able to bridge the gap between the interests of amateurs and the duties of professional scientists. He guided the affairs of such informal organizations as the Cooper Ornithological Club and in later years contributed toward the solution of more formal problems of a huge university. He traced the results of much theoretical discussion of wild animals to the hesitant steps toward application of it in nature. And he had opportunity to see the fruits of his many studies supplied to numerous classes of students by his own methods of teaching. All of these privileges and duties he met and exercised with such relish and determination as to gain the respect and admiration of all his associates.

This continuous series of accomplishments was made possible by the development of the Museum of Vertebrate Zoology, established in 1908 at the University of California by Miss Annie M. Alexander. Experience already gained by Miss Alexander in the organization of zoological exploration, especially in Alaska, the site of Grinnell's main previous field experiences, made it natural that the plans of these two would mature so as to meet the preferences of both. Thus was established not a rigidly designed and prescriptively controlled storehouse of miscellaneous materials assembled by chance, but a flexible working procedure which made possible quickened realization of the plans of the Founder and the Director. Each could have made important discoveries alone, but their combined resources brought exceptional results.

The new arrangement came at a critical time in Grinnell's studies, for already the forced requirement to make a living by the conventional duties of teaching was threatening to absorb his energies. His proposed work on mammals of the Pacific Slope of Los Angeles County had to be given up on this account. By 1908, however, his acquaintance with the West and its fauna and with zoological workers in his region and elsewhere had so provided him with sufficient knowledge of the needs and aim of a research museum that only a short tour of eastern museums was needed to allow an expansion of his own plan for study and to put it into operation at once. He was enabled to invite several naturalists to join in the new undertaking and thus to speed up the assembly of its products. A possible secret of his successful management was his practice of taking the major part of responsibility, troubles, or punishment whenever they came to the

group, and a minor part of resources, rewards, or favorable opportunities if they came. He insisted that others in the Museum worked *with him*, not *for him*. Each worker, moreover, shared sufficient responsibility to make it seem an appreciable part of the burden. This was truly a group enterprise.

Grinnell brought to the new museum the notion that research warranted emphasis over exhibition in such an institution as a part of a large university. Energies then were directed to accumulation of specimens of terrestrial vertebrates in the region immediately about him, that is, along the Pacific coast. Innovations were the supplying of field collectors with materials for making extensive records, including photographs, in the field, to supplement the many items placed on the labels of specimens. A special aim was to make accurate and full record of faunal conditions for use after lapse of many years, possibly a century. Deliberate choice was made to study animals in the wild state, under natural conditions, rather than to adopt prevalent experimental methods, under artificially imposed conditions. This was to gather evidence as to the causes and methods of evolution. He deplored the too eager search for generalizations on insufficient basis of fact and set out to make the museum a repository of facts with full realization that the ultimate value of the facts lies in their service as indicators of general truths.

Another intention was to make the museum a popular bureau of information as regards the higher vertebrate animals of the region. This function developed to such a degree that great numbers of naturalists came to visit Professor Grinnell. The line which came to his door included all ranks of professional and amateur workers, from local and distant places. Reasons for coming were many and varied. But always they found easy access to the place, a genuine greeting of welcome, and willing help or a sympathetic ear for whatever problems seemed important. These visits could be made at any hour, despite recurrent resolves to set up a more rigid program of working time. The appearance at the door of some birdman was sufficient to bring immediate postponement of any normal task. And hundreds of holidays and Sundays were given to this part of the anticipated work of the museum.

He did not wait always for naturalists to find him, but on ten trips to eastern United States, and in the West whenever opportunity came, he hunted up persons of all sorts who had interest in or concern with the outdoors. Visits to museum curators, teachers, taxidermists, fur buyers, hunters, trappers, game wardens, and collectors brought lasting friendships. His activity in tracing the changes in animal popula-

tions led him to enquire searchingly into the history of California and he enjoyed every opportunity to discuss with old-timers their recollections of early conditions. These friendships were kept alive by the practice of writing letters on occasions other than when they were required. These were greatly appreciated by the recipients.

In his regular annual report to the President of the University, on July 1, 1930, Professor Grinnell began with the statement that, "since the founding of the Museum of Vertebrate Zoology by Miss Annie M. Alexander, in 1908, there have been two further occasions of superlative importance in its history. I refer, first, to the endowment in 1920 of the Museum by Miss Alexander; and second, to the transfer during the past year, of the Museum into the new, admirably safe quarters in the Life Sciences Building provided through State appropriation." These events greatly accelerated the progress toward realization of the functions as outlined at the start of the institution. They made possible an added responsibility, that of offering more effective instruction in regular classes and courses in the university. For ten years the demand for guidance in graduate studies increased until it came to take an unduly large part of the resources of the museum. Most important of these resources was the vitality of its Director. He continued to give more and more energy to the needs and problems of his students without slighting appreciably the vigorous pursuit of his own study. These problems were not settled with the departure of the student, but became then more complicated and more urgent.

So generally acknowledged and valued were Professor Grinnell's experience and his faculty for applying it, that his opinion was sought widely by persons with biological problems. His desk usually held a stack of requests for references from applicants seeking jobs, grants, or permits. These came even from persons he had never seen! His identification of a specimen was greatly treasured by some collectors. Numerous workers undertaking new studies in the field asked his help in selecting suitable areas, equipment, and procedures. The nature of his aid in editorial matters, already indicated, was considerably more important than is apparent from the printed record, even though recipients were thankful in acknowledgment.

The problem of how much to enter into questions of human interference with wild animals and their environments was a difficult one, for such activity meant postponement of more exciting, if not more important, work. In a few instances, however, the need seemed to be greater than the required sacrifices, and facilities of the museum were used to make available facts of critical significance in some cur-

rently pressing conservation topic. Always it was his aim, however, to refrain from needless debate and to return to normal studies as soon as possible. For this reason Grinnell avoided service on committees where prolonged discussion of controversial topics would produce little of permanent worth. He made it a practice, when it seemed desirable to attend such a meeting, to read his contribution, prepared as concisely as possible. And on a surprising number of occasions his conclusions prevailed.

When Grinnell indicated in the early days of the Museum that the facts he would assemble in it would come to have special value at the end of a century, he had no way of knowing how great the changes would be in his own lifetime or what progress he could make toward fulfilling that aim. Although he frequently recalled examples of opportunities that had slipped by without the saving of some materials or information no longer obtainable, these were insignificant when compared with the accomplishment during the thirty years of his guidance. In that time, surely, enough facts were gathered by the museum and enough use was made of them to justify all the support of its Founder, the efforts of its Director, and the encouragement by the University authorities who helped in its development.

In writing of his close friend Richard C. McGregor, Grinnell ended his account with a series of sentences which require almost no modification to describe the most productive period of his own life. With minor deletion and substitution of proper names, the selection, as follows, becomes particularly apt here: It is clear that his college training at Stanford where systematic zoology was then fostered, and his years of field work and writing concerning west-American birds in an area where rivalries were keen and wits thereby sharpened, all together gave him the best possible background from which to launch work. Arriving in Berkeley, with then modern methods and ideas at his command, with ability to plan long-time productive programs of exploration, and with tireless resolve to put these programs through to completion, Grinnell found his niche and occupied it with almost unique success. From first to last, Joseph Grinnell was consistently an ornithologist. And the essential segment of world ornithology which he contributed pertained to the Californias. Ever will his name and that of this region be associated in the annals of natural science.

Joseph Grinnell was never especially strong or robust physically, and his remarkable stamina and energy were dependent on careful use of his strength. He religiously avoided overtaxing himself and

thus was able to keep active with no serious interruption until the fall of 1938. Then, as he was beginning a year of leave from his normal schedule of duties at the University, a coronary occlusion demanded a long period of convalescence. Through most of the winter he did an extra amount of reading, continued his program of 'avian bookkeeping,' and drew up many plans for the future. But a second occlusion on May 29, 1939, in Berkeley, terminated the era of Grinnell in Californian natural history.

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**REPORT OF THE COMMITTEE ON BIRD PROTECTION, 1941**

DESPITE handicaps imposed on this Committee by reason of its widely scattered membership, we have tried to present a fairly complete and up-to-date account of bird-protection matters north of the Rio Grande. As in previous years, we are indebted to many persons for information. To those who have contributed data or suggestions, we wish to express appreciation.

**GENERAL CONSIDERATIONS**

The Fish and Wildlife Service has continued its tremendous task, in cooperation with the States, of protecting the migratory birds of the continent during their residence in the United States. The bureau reports that, on June 30, 1941, it was administering 267 wildlife refuges covering a total of 13,626,022 acres of land and water. Migratory waterfowl are the primary birds accommodated on 178 of these, with an acreage of 3,440,074. Fifty areas, comprising 107,679 acres, are chiefly for colonial nesting birds. The remaining 39 refuges and ranges of 10,078,269 acres are used by upland- and big-game, fur-bearers, and birds.

Federal and State authorities have made progress toward better bird protection in the Florida Everglades. Due to reluctance of land owners to part with mineral rights, prospects for fulfilment of the Everglades National Park Project have not been promising. It is now possible that a federal wildlife refuge can be set up to protect the valuable species of southwestern Florida, at least until the park can be established.

The Fish and Wildlife Service has continued its research into the life histories, food requirements and other details, a knowledge of which is so necessary to the proper conservation and management of wildlife. Limited space forbids even mention of the many pieces of research under way.

The National Forests are important as homes for birds of many species. One of the rarest and most endangered of these is undoubtedly the California Condor. Special measures, to be described later in this report, have been taken in an effort to ensure the preservation of this bird. Four areas are closed to trespass in the interest of vanishing species and serve as sanctuaries for many other species as well. Forty-nine 'natural areas' are preserved undisturbed for the study of the vegetation and animal life. These range in area from 126 to 6,400 acres, and total nearly 64,000 acres. The 72

'wilderness areas' contain fourteen million acres. Portions of these lands are closed to hunting.

Some of the important species subject to heavy hunting pressure, including the various forms of quails, grouse, pigeons, wild turkeys, ducks, geese, woodcocks and pheasants, are found in the National Forests. Of these birds, the Ruffed Grouse, is the most numerous, followed in turn by the Bob-white, Mourning Dove, Gambel's Quail and Blue Grouse. According to Dr. H. L. Shantz of the Forest Service, about 48,000 Wild Turkeys inhabit the National Forests and are about equally divided between eastern and southwestern areas.

Continued efforts of the National Park Service have been directed toward protection and conservation of nationally important bird species, some of which have recently reached numbers where they can be expected to survive only if most stringent protective measures are taken. The Singer Wildlife Refuge, Louisiana, has again been studied, and urgent recommendations made for immediate action on S. 329 (to create the Tensas Swamp National Park) in order to preserve a sizeable portion of forest upon which the Ivory-billed Woodpecker is dependent for habitat. Recent appropriation of funds by the State of Texas promises early establishment of the Big Bend National Park, which will augment protection of rare species indigenous to this arid region. Some progress has been made on food studies of the Hawaiian Goose or Nene. Research and protection for the primary benefit of rare birds and those nearing extinction have stimulated interest in extending greater protection elsewhere.

Over vast areas of this country, the reestablishment of vegetation is essential to wildlife restoration and conservation. The Soil Conservation Service has continued its work, much of which is of direct benefit to bird life. Since its inception and up to the end of 1940, the Service has written more than 146,000 farm plans, covering over 44 million acres. Nearly eleven thousand reservoirs and ponds have been built, many of them providing food, resting and nesting conditions for waterfowl. Under State or Federal orders hunting has been prohibited on a total area of 418,484 acres of land under administration of the Soil Conservation Service. In addition, a 49,200-acre National Wildlife Refuge has been set up on which wildlife administration is vested in the Fish and Wildlife Service.

The National Audubon Society, one of the most active of the non-governmental agencies interested in conservation matters, has continued its watch over rare birds and other wildlife. Research on the Roseate Spoonbill was continued by an Audubon Society staff mem-

ber. Publication of results of the studies of the California Condor, the Ivory-billed Woodpecker and the desert bighorns is planned.

The Audubon Society also reports favorable nesting conditions and production of young on a number of its southern sanctuaries. In the coastal-lagoon area of Texas the results have been outstanding. Large broods have been reared by such birds as Roseate Spoonbills, egrets, herons, ibises, cormorants, pelicans, gulls and terns. While the results in Florida areas have not been so spectacular, the Society's five full-time year-round wardens have again guarded enormous numbers of birds in the southwestern Florida and Okeechobee-Kissimmee regions.

The influence of the Audubon Nature Camp has already become a significant factor in the development of American public opinion on bird and other conservation subjects. The Camp's graduates are scattered through 37 States, as well as four Provinces of Canada. Some 70 per cent are engaged in teaching, while many others are leaders in the Boy Scout, Girl Scout and Camp Fire Girls groups.

We regret that in this report we are unable to give an adequate resumé of the efforts made by numerous other groups and organizations to obtain facts or to further public awareness of bird-protection problems. The American Wildlife Institute and the National Wildlife Federation are among those whose work reaches many who are not subject to influence of the 'bird societies.' These two organizations are especially effective in influencing leaders in the political and business fields. Current 'conservation' pages in the journals are filling a desirable need for the ornithological groups. The resumé of wildlife problems contributed to 'The Auk' by Mr. Francis H. Allen is an example, which has been followed by the 'Wilson Bulletin.' We believe that these efforts to keep ornithologists in touch with critical bird news is praiseworthy and should be continued.

A number of outstanding achievements in bird protection have been made during the period since our last report. The first event, the signing on October 12, 1940, of the Convention on Nature Protection and Wild Life Preservation, opens the way to better bird conservation throughout the Western Hemisphere. This treaty calls for the establishment and extension of national parks, monuments, refuges and other areas on which wildlife must be protected. Rare species can be designated as national monuments. Individuals of such species would thenceforth be under the protecting mantle of the law despite their wanderings from conventional refuges. The treaty also makes it possible to extend the principles of the migratory-bird treaty acts, now existing between the United States, Canada and

Mexico, to other countries south of the latter. It is to be hoped that the admirable provisions of this Convention may be enacted into the legal codes of all American republics.

**FEATHERS IN MILLINERY.**—About two years ago, to the astonishment and dismay of the bird-loving public, plumage began to be a feature of fashionable headgear for women. The cycle of bird destruction for millinery seemed about to return after a period of three or more decades. We have to thank again the National Audubon Society for sounding a call of alarm and, with the cooperation of other organizations, for indefatigably bringing the issue to its present stage. A new plumage law of New York State, the American headquarters of the trade, makes illegal any traffic in wild-bird plumage beginning April 16, 1947. On that date, legal trade will henceforth be limited to the plumage of ten specified kinds of domestic fowl. Similar restrictions should be adopted by the other 47 States and by the Congress for the District of Columbia. Ornithologists everywhere should join their forces with other groups to secure suitable legislation, and to ensure that fish-fly manufacture will not be allowed to serve as a loophole for the law.

**DEPLETION OF ENVIRONMENT.**—Much concern continues to be felt for the safety of many of our bird species. Destruction of environment continues in certain critical areas, to the great detriment of members of the avian fauna that are dependent upon it and whose habits are so exacting and inflexible as to make impossible a shift to other habitats. In some instances, the populations have reached or even exceeded the carrying capacities of their habitats. Restoration or dedication of additional areas for use of the birds is then the only solution for expansion. In other cases, and despite the most violent denials by some sportsmen, excessive hunting continues to be a constant menace.

#### SPECIAL SPECIES

**GREAT WHITE HERON.**—Probably less than eight hundred individuals of the Florida representative of the Great White Herons are alive today. The range of this species is restricted and subject to destructive hurricanes. It is possible that the 'Great Whites' can never be assumed to be 'safe.' Constant care must be exercised to increase the population and to maintain it at a high peak, with the hope that the species will spread somewhat northward and the effects of storm damage therefore will not be so devastating. The Great White Heron Refuge in the Florida Keys is continuing to provide better protection for this and other rare or extra-limital species.

**ROSEATE SPOONBILL.**—Several favorable reports of Roseate Spoonbills have come from Gulf Coast refuges of the Fish and Wildlife Service. During the spring of 1941 the following records were made: on May 10, approximately 600 spoonbills were seen on the Second Chain of islands bordering the Aransas Refuge near Corpus Christi, Texas; on May 19, at least 150 spoonbills were on the Sabine Refuge, Louisiana; and on May 30, 53 birds were noted on the Indian Key Refuge near St. Petersburg, Florida. Numerous other observations of lesser numbers were made on these areas during April and May, all of which are encouraging.

**DEPLETION OF WATERFOWL.**—The waterfowl of North America constitute an example of birds that have been greatly reduced by a combination of destruction of habitat, adverse weather and excessive shooting. We are becoming convinced that hunting is now a critical factor preventing speedy recovery of the birds. Waterfowl nesting conditions in the north-central United States were excellent this season. Recent reports indicate that eastern Canada has had a normal nesting population, but those from the Prairie Provinces are not assuring. A competent observer, who is intimately acquainted with the situation over a vast area, writes as follows: "Frankly, I should like very much to report more optimistically, but under the circumstances this is impossible. Locally, of course, the picture is a bright one full of encouragement with a wealth of ducks of several species and good broods of young. But this condition is conspicuously local in all respects. In some instances the numbers of birds were definitely disappointing, and many dry potholes and sloughs are of course destitute of waterfowl."

The 1940 hunting-season kill of ducks and geese is believed to be almost equal to the year's crop. The upward trend of the waterfowl population, following the low ebb of 1935, has conspicuously leveled off during the past year. The net increase is only slight—possibly 5 to 8 per cent. The breeding population of some species that return to the nesting grounds is still too small for safety. Some waterfowl, such as the Redhead, continue to be in a precarious condition. Nevertheless, unscrupulous or uninformed groups of sportsmen clamor for further relaxation of restrictions on hunting.

The steadily increasing number of waterfowl hunters has now almost overtaken the gains that close hunting restrictions allowed the waterfowl to make between 1935 and 1940. Nearly everyone admits that 'luck,' in the form of poor hunting weather, alone prevented a huge kill in the fall of 1940. We believe that the concessions made

to hunters—longer season, longer shooting days, increase of the 1939 possession limit—are unwise.

The recently announced liberalization of gunning regulations permitting the daily take of one Wood Duck per hunter, during the sixty-day hunting season, in fifteen States of the South and Southeast should be carefully watched to determine the effect on the status of the species.

**CANVAS-BACK AND RUDDY DUCKS.**—It appears to your committee that the return of the Canvas-back and the Ruddy Duck to the list of species with the daily 10- and 20-bag and possession limit is a grave error and an act for which there is insufficient justification. While an increase has been noted in both of these species of divers, these birds are still rare or uncommon over vast areas where they were formerly abundant. It is generally admitted that the Redhead is in a precarious condition. The fact that this bird is not easily distinguished from the Canvas-back and commonly associates with it, makes the security of the Redhead still more precarious by the lack of protection given the Canvas-back.

**Ross's GOOSE.**—Decidedly smaller numbers of the Ross's Goose were seen on the Sacramento National Wildlife Refuge, California, during December 1940, as compared with those of the preceding year. This species continues in need of special protective measures. Closing the hunting season for several years on all white 'geese' west of the Great Basin (or at least in California, the principal wintering area) would not seem to be too severe if the Ross's Goose is to be saved.

The Federal authorities are to be commended for the amendment to the regulations which provide that "no person may take more than 3 geese in the aggregate of all kinds during any 7 consecutive days" in Hyde County, North Carolina; Alexander County, Illinois; or Siskiyou County, California. These special county bag limits represent an experiment in Federal game management and are designed to curtail excessive kills in areas where geese (especially Canadas) concentrate during the hunting season. In some of these regions more than one third of the entire wintering goose population has been killed off during the hunting season. A reduction in the kill in these concentration areas is therefore a genuine conservation measure.

**TRUMPETER SWAN.**—Increase of Trumpeter Swans continues to be very slow. The United States population of this species as of August 15, 1941, was counted at only 211 birds. More than double this number is believed to exist in western Canada, yet the dangers confronting the swans make this hold on life all too slender. No increase is known to have followed the planting of six adult swans (only

three of which survived) in Jackson Hole in 1938 and of three more at the Malheur National Wildlife Refuge, Oregon, in 1939, of which only two survived. It is possible that poaching, or stupid confusion of swans for legal game, is responsible for holding down the numbers of birds in the United States. We therefore highly commend the United States Fish and Wildlife Service for closing the season on Snow Geese in Idaho. While we support this action, we feel that a closed season for Snow Geese in the Montana counties adjacent to Red Rock Lakes Wildlife Refuge and Yellowstone National Park would be of at least equal benefit to the swans. This would remove any possible excuse for the killing of Trumpeter Swans by hunters who confuse these two white birds. We also commend the Emergency Conservation Committee for its initiative in directing and supporting an educational campaign among the people of southern Idaho, southwestern Montana and northern Utah regarding the identification and status of these majestic birds. It is to be hoped that this campaign, although modest in size, will accomplish its purpose of making safe the wintering ground of the Trumpeters of the United States.

Additional dangers to the swans have recently arisen in proposals for major military projects in the region. Fortunately these have been cancelled.

**OIL POLLUTION.**—Loss of seabirds by oil pollution continues to be sporadic but nevertheless important. We have had reports that several hundred ducks come ashore on Cape Cod each winter, their plumage saturated with the heavy residue of fuel oil pumped overboard from vessels. A considerable number of these birds succumb. This waste oil cannot be legally discharged in American waters, but nevertheless it may drift for long distances. The person who finds a market for this unused heavy oil will do a tremendous service to oceanic and coastal bird life.

Oil pollution in the eastern North Atlantic Ocean and North Sea has been much intensified in the past two years because of the war. The lighter and more refined oil from sinking vessels saturates the plumage of birds more rapidly and completely than does the residual crude waste. We are informed that loss of bird life along the English coasts is greater than ever before, and that at least one organization of private citizens has been formed to rescue oil-soaked birds when possible. Another report states that windrows of dead, oil-blackened ducks have been seen on the Dutch shores. Let us hope that this does not foreshadow the shape of things to come on the western side of the Atlantic.

**CALIFORNIA CONDOR.**—Little new information on the status of the California Condor has reached us. Under a National Audubon Society research fellowship, Carl Koford has assembled a mass of data and management suggestions. He is satisfied that there has been no further decline and perhaps as much as a ten per cent increase in numbers of condors during the past two years. The Forest Service is gathering records of condor occurrence through 75 fire-lookouts in southern California. The Sisquoc sanctuary of 1300 acres in the Los Padres National Forest is obviously far too small, however, to accomplish its purpose. The entire Forest should be closed to all hunting or carrying of firearms, and food should be provided the condors if it is found to be necessary.

**DUCK HAWK.**—This Committee has kept in touch with investigations on the status of the Duck Hawk. The bird appears to be more numerous than is generally suspected. Recent publicity regarding the possibility of using falcons for destruction of enemy carrier pigeons seems to be founded on such poor chances of success that it is doubtful that the wild stock of falcons will be seriously disturbed.

**BALD EAGLE.**—It is too early to determine the effects of the new legislation extending protection to the Bald Eagle population of the United States. Although Alaska was expressly excluded from the Act, the incentive for destroying eagles in the Territory was removed in March, 1941, by the Governor's veto of the bounty appropriation. Judging from the scarcity of this bird over great areas of its range in Alaska, even this negative protection is desirable, at least until a life-history and food-habits study now being made by the Fish and Wildlife Service is completed.

**SHARP-TAILED AND PINNATED GROUSE.**—With increasing favorable conditions in the Great Plains area, the condition of the grouse-prairie chicken group may improve. The Attwater's Prairie Chicken, however, is rapidly disappearing and is in grave danger of extinction. Except in four Texas counties, it is now extirpated from all of its former range. Cultivation, overgrazing, and other destruction of habitat, as well as local hunting, have been highly detrimental. To control the loss due to shooting, the Texas legislature in 1937 provided a five-year closed season on all prairie chickens in the State. Naturally, this should be renewed, but creation of large refuges, on which proper habitat management can be controlled, must be prompt.

The Prairie Sharp-tailed Grouse, with its western subspecies, is suffering a rapid contraction of its geographic range within the United States. This contraction of range in the West is clearly due to overgrazing and to plowing-up of the habitat by dry farmers. Shrinkage

in the Lake States is clearly due to the conversion of cutover areas from brush to closed forest, and to the usurpation of peat marshes by aspen thickets. The closing of the tree canopy on cutovers is the consequence of better fire control; the spread of aspen on marshes follows the peat fires which ran during the dry years of 1930-34.

In most western States the Sharp-tail is regarded as a 'lost cause.' This attitude seems particularly unfortunate for two reasons: (1) it seems to imply the acceptance of universal overgrazing as an inevitable and permanent condition; (2) there are ample Pittman-Robertson funds wherewith to demonstrate that relief from overgrazing will bring an upgrade in Sharp-tail populations. It is not necessary to purchase Sharp-tail refuges; in fact, leases calling for the continuance of farming but the discontinuance of heavy grazing would be preferable to the total cessation of both farming and grazing.

In the Lake States uplands the general closing of the canopy on cutover lands is unavoidable; the spread of Sharp-tails on these lands was a temporary aftermath of lumbering and free-running fires. A few spots suitable for Sharp-tails could be saved, however, if State and Federal foresters would cease planting all openings to conifers.

In Lake States marshes the general encroachment of aspen thickets on former hay meadows is the natural penalty for former peat fires. Wisconsin is experimenting in controlled burning as a means of reducing aspen. This may work, if the burns are superficial. If the fires are allowed to bite deep, it will aggravate the aspen problem.

Speaking generally, it is clear that the Sharp-tail is fast losing its position as a shootable game bird. The next decade may bring the virtual elimination of the Columbian subspecies, and the reduction of the Lake States Sharp-tail to non-shootable levels.

Many people believe that the abundant 'Prairie Chicken' of western Canada is the Pinnated Grouse. This is not true. There are very few Pinnated Grouse in Canada, and these are confined to the border. The Canadian 'Prairie Chickens' are Sharp-tails.

In the United States, the main stronghold of the Pinnated Grouse in the Lake States is fast shrinking, and for the same reasons as the Sharp-tail: the encroachment of aspen on marshes, and the encroachment of timber on the cutover land. Further south in the dairy belt grazing, drainage, and pheasants are evicting remnants of Pinnated Grouse with exceptional rapidity. Southern Wisconsin, northern Illinois, and northern Indiana may lose these grouse within a decade. The reverse, however, is true of southern Illinois and Missouri, where 'poor' prairies are reverting and Pinnated Grouse

are on the upgrade. Recent literature indicates rapid shrinkage in Texas and tolerable conditions in parts of Oklahoma.

The recent retirement from farming of large new military reservations ought to provide an excellent opportunity to restore both the prairie flora and the fauna, including Pinnated Grouse.

'Game-restoration' efforts in many States are concentrated on raising and liberating Ring-necked Pheasants, Hungarian Partridges and other exotic game birds. If long continued to excess, this practice may not only replace but even exterminate some of our native game birds. We believe that a larger percentage of available funds should be spent for research and for habitat improvement. More emphasis should be placed on encouraging natural propagation of native game birds.

**WHOOPING AND FLORIDA CRANES.**—Estimates made in 1938 placed the Whooping Crane population at less than 300. An intensive field study of winter food habits is under way in order to determine management methods of Federal and Audubon Society refuges on the Gulf Coast. As crane wintering grounds, the most important of these is the Aransas National Wildlife Refuge. Twenty-six Whoopers, of which at least five were immature, were seen here on December 17, 1940. Whether production of young has kept pace with losses is not known, but the Whooping Crane is certainly in a precarious state.

In the Okeechobee-Kissimmee region the Florida Crane has had a good nesting year. An encouraging report comes from southern Georgia of a flock of 150 seen near Dinner Pond in the Okefenokee Swamp.

**WOODCOCK.**—Following more than fifteen years of gradual increase, the Woodcock population has definitely and seriously slumped. As a result of the storm disasters of early 1940, the hunting season in the United States and Canada was reduced by one half. Subsequent studies have shown that this measure was not enough to bring about recovery. Although fairly good reproduction occurred in the Maritime Provinces, the breeding stock was definitely lower in the eastern United States for the second successive year.

In view of the precarious status of this bird, it is both disappointing and surprising that fourteen different open-season periods should be provided to insure the most favorable shooting for the hunters in the various States and sections of States where the bird occurs. New York, for example, is divided into three zones and while the hunting period in any one zone is limited to fifteen days there is a total limit of 45 days for the State as a whole and a period of 90 hunting days for the eastern United States where the bird occurs. For a species

that lays but four eggs and rears but one brood a year and has such a limited distribution and habitat range, further restriction on the take appears to your committee to be imperative.

**WILSON'S SNIPE.**—The numbers of Wilson's Snipe are "startlingly small" as compared with those of ten to twenty years ago. Until definitely normal, these reduced populations should not be subjected to hunting. We are gratified that Federal officials have recognized the precarious situation that exists and have therefore placed this bird under full protection for the present year at least.

**WHITE-WINGED DOVE.**—The plight of the White-winged Dove has become increasingly serious and its management problem is complicated by the international character of its range.

The Texas breeding population of the Eastern White-wing, which is an important game bird in southeastern Texas and especially in the lower Rio Grande Valley, is decreasing at an alarming rate. It has been reliably reported that as recently as the fall of 1924 there were in the lower Rio Grande Valley at least twenty major flights of these birds which totaled at least four million individuals. In the fall of 1940 Federal and State field investigators estimated that fewer than 250,000 'White-wings' were present in the same area. Word just received indicates a further decided decrease in breeding stock in 1941 as compared with that of 1940.

A joint Federal-State research project on both eastern and western White-wings is now in progress. Its purposes are to determine the means for safeguarding the population of White-winged Doves which breeds in the Rio Grande Valley and in southern Arizona. The results of this investigation will undoubtedly indicate required changes in hunting regulations, as well as recommend a plan for the acquisition and management of nesting-ground refuges. Sufficient work was done in 1940 by Federal and State investigators to show that the serious decline in the Eastern White-wing was due to (1) drastic reduction in acreage of nesting grounds as a result of the clearing of woodland to provide agricultural land; (2) reduced production of young as a result of severe predation by two species of egg-eating birds; and (3) too heavy kill by hunting.

The Western White-wing is in a similarly unfavorable condition. The breeding stock that returned to Arizona from Mexico in the spring of 1941 was probably considerably smaller than that of the preceding year. Since food and water conditions were excellent, it was hoped that a very successful nesting season would result. Unfortunately, indications are that predation and other factors caused 50 to 75 per cent mortality to eggs and young.

In view of the extremely critical status of the White-wing in the United States and the general recognition of the situation in the two States affected, namely, Arizona and Texas, it is most disappointing that a completely closed hunting season was not imposed. Even the organized sportsmen of Arizona officially recommended a closed season. Almost everyone in both States familiar with the situation realizes that curtailment of the take and a restoration of breeding habitat are imperative. While some restriction in the regulations has been provided, the facts at hand show clearly that a completely closed season is urgently needed. The 1941 regulations permit a twelve-bird limit each day from September 1 to September 15 in Arizona and September 16 to September 25 in Texas. Unless we wake up to the seriousness of the situation, extirpation of this economically important bird from the United States will soon be accomplished.

**MOURNING DOVE.**—Recent findings are also causing much concern for the Eastern Mourning Dove. Although an attempt was made by restrictive hunting regulations to conserve the survivors of the January 1940 storms, the number of doves at present is decidedly unsatisfactory. The stock must be protected if a good recovery is to be attained within a reasonable time. An open season and a heavy kill at this period of the bird's struggle for existence might be disastrous. It is fortunate that some curtailment of the season was provided for 1941. Nevertheless, this maximum of 42 days is still much too long under the present emergency. The Department of the Interior has recently reported that the status of the bird is "decidedly unsatisfactory."

**IVORY-BILLED WOODPECKER.**—Little new information is available regarding the Ivory-billed Woodpecker. Logging of its principal remaining habitat is proceeding rapidly, and under present conditions will probably run to its conclusion. The number of birds remaining is very low and this, coupled with destruction of the environment, makes extermination appear all but inevitable. A bill (S. 329) has been introduced into Congress to establish the area as the Tensas Swamp National Park. An adverse report has been rendered by the Bureau of the Budget, and no action has been taken by the Congress. Unless public demand and interest are shown, little progress can be made toward acquisition of this vital area.

**STATUS OF GAME BIRDS.**—We have mentioned some of the dangers confronting bird species in America. In several cases these are so-called 'game species,' and a vociferous minority of the hunting fraternity is a menace to some of them. We have no quarrel with the

thoughtful, informed sportsmen who desire reasonable shooting of species that can stand the drain. Unfortunately, however, a considerable number of hunters seemingly desire to kill to the limit of their gun capacity, and let tomorrow take care of itself. This group is noisy and frequently influential. Because its platform is spectacular and appeals to personal selfishness it is frequently supported and publicized by some of the 'sportsmen's' magazines. Conservationists should not hesitate to oppose this group and their publicity. A dignified silence will never express reasonable protection sentiment to administrators and legislators who are bombarded with demands for longer hunting days and seasons, legalization of baiting and live decoys for waterfowl, and other excessive devices.

Realization of the value of predatory birds is increasing but slowly. In a recent publication we regretted to note a recommendation for pole-trapping of raptors, by farmers and sportsmen, for the protection of pheasants. The author points out that "with the trap jaws padded, the harmless forms can be released." Indiscriminate pole-trapping should be outlawed. We are reluctant to believe that the sponsors of this bulletin really stand behind this inadvertent statement in an otherwise commendable publication. (A substitute statement, signed by two members of this Committee, is appended to the report.)

#### RECOMMENDATIONS

The haste and waste that inevitably and unavoidably accompany the current national-defense program carry many direct and indirect hazards to bird life. This Committee would not be so foolish as to oppose any legitimate military demands essential to the safety of this country. Through the liaison established between federal conservation agencies and the military establishments, means exist for working out protection for birds where possible. But, unfortunately, unnecessary destruction will occur. Bombing- and gunnery-practice areas may be laid out on important bird-nesting or feeding grounds when other sites could be substituted. Marshes will be drained in attempts to secure immunity from mosquitoes. Power development projects will run wild, converting valleys now fertile for waterfowl into practically sterile storage reservoirs. Heading the list of this Committee's recommendations, therefore, we suggest that:

1. Information on military projects that would appear detrimental to important bird habitats should be sent at the earliest possible moment to the Fish and Wildlife Service, Washington, D. C.
2. Public support should be given to any measure, such as S. 329,

that would result in acquisition and protection of the last important habitat of the Ivory-billed Woodpecker.

3. Support should be given to establishment of a wildlife refuge for further protection of the unique bird life of southern Florida.

4. As soon as possible after adoption of the Convention on Nature Protection and Wild Life Preservation in the Americas, the Congress of the United States should enact legislation to give effect to the Convention's numerous provisions for protection of rare birds and other animals.

5. We hope that legislation will be enacted by the several States to make illegal the traffic in wild-bird plumage for millinery purposes.

6. Again we urge the California Division of Fish and Game and the Fish and Wildlife Service to close the Sacramento Valley to the shooting of all white geese, in order more effectively to protect the Ross's Goose.

7. The regulations governing hunting of waterfowl should be made more restrictive, until very definite further gains of the breeding-bird populations indicate that more intensive hunting may be allowed with safety. The Ruddy Duck and the Canvas-back should not be subjected to the '10- and 20'-bag limit.

8. The Fish and Wildlife Service, the National Park Service, and the several States are urged to study and carry out measures for the better protection of the Trumpeter Swan. Measures in addition to those now in force should include: exclusion of fishermen and other persons from nesting areas; posting of swan-use areas, whether in public or private ownership; and education of the hunting public on means of distinguishing swans from legal game. The Snow Goose season should be closed in Beaverhead, Gallatin and Madison Counties, Montana.

9. The entire Los Padres National Forest should be closed to all hunting and food provided therein, if needed, as a means of protecting and increasing the numbers of the California Condor.

10. We repeat our recommendation of last year that the Arizona Game Commission, the Texas Game, Fish and Oyster Commission, and the Fish and Wildlife Service should declare a continuous closed season on the White-winged Dove.

11. Marked restriction of the hunting kill of the Woodcock and Mourning Dove is imperative.

CLARENCE COTTAM

ALDO LEOPOLD

WM. L. FINLEY

VICTOR H. CAHALANE, (*Chairman*)

## SUBSTITUTE STATEMENT ON POLE-TRAPPING OF RAPTORS

Realization of the value of predatory birds is increasing but slowly; control operations indefensible from any enlightened point of view continue not only to be carried out, but to be officially sanctioned by conservation agencies. Thus Oregon State College, the Fish and Wildlife Service, and the American Wildlife Institute are the joint sponsors of a bulletin recommending pole-trapping of raptors, by farmers and sportsmen, for the protection of pheasants. Pole-trapping, we thought, had long been outlawed by "the decent opinion of all mankind." We are reluctant to believe that these three agencies, each of which has done such excellent conservation work in Oregon, really stand behind this publication.

\* ALDO LEOPOLD  
WM. L. FINLEY

## GENERAL NOTES

**Unusual occurrences of Pied-billed Grebes.**—On April 19, 1940, I had the opportunity to examine an adult Pied-billed Grebe (*Podilymbus podiceps podiceps*). The bird had been captured by a motorist the day before on a macadam highway near Franklin, Warren County, Ohio. While traveling along, the motorist's attention was attracted by a movement on the road. He was amazed to find that the cause of the disturbance was an adult Pied-billed Grebe attempting to take off from the roadway. The motorist claims that the bird was able to fly about sixty yards when tossed into the air, but it apparently was unable to continue its flight beyond a short distance. There were no streams within 300 yards of the site where the grebe was found, and there were no power lines above this portion of the highway that the bird might have struck during flight. When I examined the grebe the following day it acted and looked as though it were in good physical condition. It bore no signs that would indicate injury.

Later, during the cold, rainy day of April 19, 1940, I saw another Pied-billed Grebe that had been killed on U. S. Highway Route 42 about halfway between Lebanon and Xenia in Greene County, Ohio. Judging from the condition of the body the grebe had been killed but an hour or so before, during the daytime. This bird, likewise, was some distance from a lake or watercourse. This specimen was an adult male. Its gizzard contained a snail shell, a small amount of an aquatic plant, probably duckweed, and a large quantity of grebe feathers.

About two days later (April 20, 1940) another adult grebe of the same species was taken captive from a small stream near Mt. Carmel in Clermont County, Ohio. The stream was not more than three feet wide and six inches deep. The farm boy who captured it saw the grebe swimming on the surface of the brook and only when he attempted to catch it did the bird make repeated efforts to dive. This grebe was kept a captive for two days before it finally died; the sex and condition of the internal organs were not determined. Residents in the vicinity where the grebe was captured claim that this was the first time they had ever seen this species of bird.

That three Pied-billed Grebes were found under such strange and similar circumstances at rather widely separated areas and within a period of three days seems worthy of record.—HUBERT BEZDEK, *Ohio Division of Conservation, Batavia, Ohio*.

**Southward Migration of Greater Snow Geese in 1940.**—Through correspondence between the authors, the following detailed information concerning a part of the autumn migration of the Greater Snow Goose (*Chen hyperborea atlantica*) in 1940 has been pieced together.

On their customary feeding-ground on the marshy tidal shore between Cap Tourmente and St. Joachim, Quebec, on the north side of the St. Lawrence estuary, about thirty miles northeast of Quebec City, Greater Snow Geese were first observed in the autumn of 1940 on September 13, when eleven individuals were present. No additional birds of this species were noted there until September 23, when the number present was between 300 and 400. Immediately after the latter date, Greater Snow Geese arrived on this feeding-ground in great numbers.

Mr. Ivers S. Adams reports that at the small islands called *Les Battures aux Loups-marins*, which are situated in mid-stream of the St. Lawrence estuary, about

eighteen miles northeast of Cap Tourmente, the first Greater Snow Geese seen in the autumn of 1940 were 32 on September 13. On September 15, there were 425 of these birds at that place and, on September 19, 1500.

It is of interest to note, in comparison with the data for 1940, that on September 8, 1939, 5000 Greater Snow Geese had already arrived at Cap Tourmente and vicinity. There were very few young birds in the flock in 1939, but in 1940, young birds were exceptionally numerous. If there is a correlation between the reproductive success of these geese and their time of arrival, southbound, at the St. Lawrence estuary, it may conceivably be due, on the one hand, as in 1939, to the fact that a late-summer blizzard on their Arctic breeding-grounds may simultaneously destroy the insufficiently developed young and stimulate their parents to early departure, and, on the other hand, as in 1940, to the fact that, in a successful year, need for awaiting development of adequate ability for flight in the numerous and generally distributed young may cause some delay of the greater part of the flock.

The total number of Greater Snow Geese at Cap Tourmente and vicinity in the autumn of 1940 was estimated locally to be about 18,000.

The principal flock of Greater Snow Geese left their feeding-ground near Cap Tourmente during the night of November 22-23, 1940. Their departure was not due to the arrival of a cold wave, for the minimum temperature at Quebec City, on both the night of departure and the previous night, was 34° F. Rain fell on November 22 until 4:30 p.m. The wind was northeast, with a velocity of about 30 miles an hour, and was therefore nearly fair for birds whose presumed course was about south-southwest.

The manager of the Bombay Hook National Wildlife Refuge, in Delaware, reports that the first authentic record of Greater Snow Geese on that refuge in 1940 was made on November 11, when 210 of these birds in one flock were observed. On the morning of November 12, the number of these geese on the Bombay Hook Refuge had increased to 750. Mounting totals recorded on later dates are as follows:

November 13 .....	3,000
November 16 .....	6,000
November 28 .....	7,000
December 3 .....	9,000
December 26 .....	11,000

Many of the Greater Snow Geese, however, migrated to more southern refuges. The manager of the Back Bay National Wildlife Refuge, in Virginia, reports that 3,000 Greater Snow Geese were present there during the period November 24-30, 1940, but does not state the date of their arrival.

The manager of the Pea Island National Wildlife Refuge, at Manteo, North Carolina, reports that five Greater Snow Geese, the first of the season, arrived there on October 23 and that the number of birds of this species present there slowly increased up to November 19, when 185 were noted. On November 26, about 2,000 of these geese had arrived there. A flock of 500 additional birds came in on the following day. The total number of Greater Snow Geese present on this refuge had increased to 3,000 by December 2 and to 5,000 by December 5.

As there is every reason to believe that the flocks reported at Bombay Hook, Back Bay, and Pea Island are separate and distinct, it appears that some 19,000 Greater Snow Geese were present in these three refuges in the latter part of 1940.

A few other Greater Snow Geese were probably to be found at the same time on other areas along the Atlantic coast of the United States. An estimate of the total population of Greater Snow Geese arrived at from these data is somewhat in excess of the estimate of 18,000 formed at Cap Tourmente, Quebec. The difference may be due to differences in methods of forming estimates of large numbers of wild geese, or it may be that not all of the Greater Snow Geese were present in the vicinity of Cap Tourmente at any one time.—CHARLES FRÉMONT, HARRISON F. LEWIS, and FREDERICK C. LINCOLN.

**Greater Snow and Blue Geese in New Jersey.**—During the last few years, members of the Urner Ornithological Club have found Garret Mountain Reservation in Paterson, New Jersey, an advantageous place to observe migrating hawks and crows and lesser birds. Occasionally waterfowl have been seen passing over various spots along the Watchung Mountains and vicinity. On Sunday, April 13, 1941, Messrs. E. B. Lang, R. Burkhart and F. P. Wolfarth were watching for passing hawks which had proved all too scarce that morning. In the distance we caught a glimpse of long wavy lines of approaching waterfowl and in a few moments saw the birds overhead, many of them calling in typical goose fashion. They were Snow Geese, presumably Greater Snow Geese (*Chen hyperborea atlantica*), and flew at about 800 feet above the rock lookout. The birds were continually changing formations, with no distinct leader, and some of the geese were bunching in dense groups. This was at 9.12 a.m., and the estimated number was 350 birds. No effort was made at that time to determine whether any Blue Geese were among them but the light was good and the white and black contrasts were very showy as the geese moved past the sun.

However, this was not to be the last of the Snow Geese for this day and at 10.04 a.m. a sight met our eyes which we had never before beheld. A great V with about a 30° angle appeared in the distance—one outside line of the V was judged to have at least 100 geese in it. Extending from this line and the other side of the V were lesser lines all forming the same angle toward the inside of the V. Not far behind came another V but somewhat smaller in length. These geese were not sounding off and flew at about 1000 feet above the rock, which lies at about 600 feet above sea-level. This time birds in one line were scrutinized closely and at least three geese with all-dark wings were noticed, which we presumed were Blue Geese (*Chen caerulescens*); these were of about the same size with identical methods of flight. The estimated number of these two flocks was about 550 birds making an approximate total of 900 geese. In these last two groups all birds remained in this beautiful symmetrical pattern and disappeared to the north-east without change. The day was fair and the temperature at that time about 50° F.; the wind blew from the west at about 15 to 20 m.p.h.; there were scattered cumulus formations with visibility of about three miles. In the past there have been reports of Snow and Blue Geese in this area but in smaller numbers.—FLOYD P. WOLFARTH, Newark Museum, Newark, New Jersey.

**Blue Geese in South Carolina.**—It may be of interest to note the following in connection with the records of the Santee Club on the Santee River, South Carolina.

In 1926, I saw there four Blue Geese (*Chen caerulescens*) which remained together for some time.

The Santee Club records show the following: November 14, 1930, Paul Thompson, Jr., 1 Blue Goose; December 11, 1933, George D. Macbeth, 2 Blue Geese;

November 15, 1934, George D. Macbeth, 1 Blue Goose; December 1, 1937, Howard S. Hadden, 1 Blue Goose.—*IVER S. ADAMS, Hardwick, Massachusetts.*

**An unusual Mallard's nest.**—Although it is well known that Mallards often nest at 'some distance' from the water, the discovery of a nest located about three miles from the nearest water-supply is, to the writer, decidedly unusual. The difference in elevation between the nearest water and the nest is about 700 feet. At the time of discovery on April 7, 1941, the nest was accidentally destroyed by a tractor, but it contained four fertile eggs. It was located in a large brushfield some six miles from the town of Mount Shasta, Siskiyou County, California. The female was flushed from the nest at the time of discovery and has since been seen in the vicinity by the writer on several occasions and is unquestionably a Mallard (*Anas platyrhynchos*). During the spring of 1940 a female Mallard was seen by a competent observer in the same area and was possibly the same bird.

Mr. E. R. Kalmbach advises me that his experience with nesting ducks in North Dakota during the drought of 1934-35 leads him to believe that some of the birds there had to travel three miles or more in order to reach water. There, however, it would seem that the nest was originally set closer to the water and that it was left 'high and dry' as the water receded. Such was not the case in the Mount Shasta nest, as no water supply, except perhaps for runoff from a storm, was closer than the distance indicated.

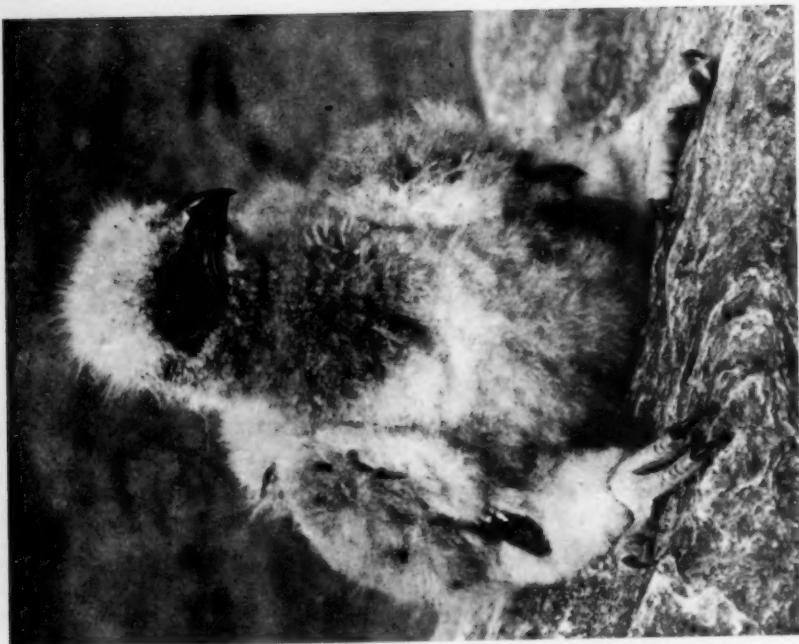
The brushfield undoubtedly provides excellent cover, and a supply of insect food such as grasshoppers that would be ample to support the young for some time, but the method by which the young reach water is not known. It is difficult to understand how tiny ducklings could with safety traverse on foot a distance of over three miles on this rugged and rocky terrain.—CLARENCE F. SMITH, U. S. Fish and Wildlife Service, Mount Shasta, California.

**Lesser Scaup Duck nesting at Churchill, Manitoba.**—On June 21, 1941, we found a nest of the Lesser Scaup Duck (*Nyroca affinis*) containing ten eggs, located about four miles southeast of Churchill, Manitoba. The incubating female was killed in order to make positive identification. This bird and also the eggs were compared with a female and eggs of the Greater Scaup Duck (*Nyroca marila*) which had been taken but two days previously, and identification of the Lesser Scaup Duck was positive. The nest was situated in dead grass at the edge of a small lake. When found no bird was seen, but on later examination the female was flushed from the nest. The nest contained no down, indicating that the set may not have been complete. The male bird was not seen.

So far as I am able to find, this is the first breeding record for this species in this locality and the only record we have for the species during the 1940 and 1941 seasons. In 'The Birds of Churchill' by P. A. Taverner and George M. Sutton it is stated that this bird probably breeds in the Churchill locality but no certain record is quoted.—JOHN R. CRUTTENDEN, Quincy, Illinois.

**Turkey Vulture and Killdeer in Newfoundland Labrador.**—Dr. E. P. Wheeler, 2nd, of Ithaca, New York, is one of those rare persons who, though not primarily biologists, nevertheless give much time and thought to biological matters. While carrying on geological studies in the Newfoundland Labrador during 1940-41, Dr. Wheeler came into possession of two remarkable bird specimens—a Killdeer, found dead by an Eskimo near Nain about November 25, 1940, and a Turkey Vulture, shot 'for a hawk' by a settler near the graveyard at Nain in the early part of the

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SIBERIAN ROUGH-LEGGED HAWK'S NEST AND YOUNG

summer of 1941. Neither of these species is mentioned in Oliver L. Austin, Jr.'s, 'The Birds of Newfoundland Labrador' (Mem. Nuttall Ornith. Club, no. 7, 1932). Dr. Wheeler brought the specimens to me recently—the former in mummified condition, the latter skinned and stuffed. The Killdeer represents the large, continental North American race, *Charadrius v. vociferus* (wing, 164 mm.; tail, 94), the Turkey Vulture, the northern race, *Cathartes aura septentrionalis* (wing, 513; tail, 271). Both are now in the Louis Agassiz Fuertes Memorial Bird Collection at Cornell University.—GEORGE MIKSCH SUTTON, Cornell University, Ithaca, New York.

**Siberian Rough-legged Hawk in northwestern Alaska.**—A female Rough-legged Hawk, identified as *Buteo lagopus pallidus*, was collected by E. W. Nelson at St. Michael's, Alaska, on September 16, 1879; one was taken by J. W. Johnson along the "West Coast of Alaska" on April 10, 1886, and a male from St. Michael's was secured on April 10, 1876, by L. M. Turner (Friedmann, Condor, 36: 246, 1934). Nelson's bird was similar in color and size to the Asiatic form; Johnson's bird was intermediate in size but large like *pallidus*, while Turner's bird was colored similarly to *s. johannis* but was large like the Asiatic race. The author noted that a dark bird from Bering Island in the U. S. National Museum was large like *pallidus*, and he suggested that this specimen and Johnson's dark bird might indicate that in a region where the two races merge the size character remains more fixed than the coloration and is therefore a more reliable criterion.

Several Rough-legs from Alaska have come to hand in recent years; and in addition, I observed a few pairs and collected an adult male with three downy young (Plate 10) on Golovin Bay north of St. Michael's on July 26, 1921. The specimens from Golovin Bay were listed as *Archibuteo s. johannis* (Bailey, Condor, 28: 123, 1926).

Prompted by Friedmann's article, I re-examined the Alaskan specimens and was struck with the similarity of our birds to his. Two adult specimens from the Chicago Academy of Sciences and two from this museum were available as follows:

No.		Sex	Locality	Date	Wing
22614	C. M. N. H.	male	Golovin Bay	July 26, 1921	434 mm.
19522	C. M. N. H.	female	Chipp River (near Barrow)		445 mm.
4211	C. A. of S.	female	Romanof Mts.		450 mm.
6298	C. A. of S.	female	Colville River		448 mm.

The Romanof Mt. bird and the one from Chipp River are light-phase specimens with the dark belly a washed-out brown not observed in any of our Colorado birds. The back feathers are edged with light. The Colville River bird is as large as the others but is dark like *s. johannis* and would compare, probably, with the Bering Island specimen mentioned above. The breeding Rough-leg from Golovin Bay is in the dark phase, but has a light edging to the feathers not matched by any of our Colorado skins. The mate to this bird was not secured, but it was a very light one.

These four skins were sent to Dr. Friedmann with the request that he identify them, and he replied, "that three of the Alaskan birds, Chipp River, Romanof Mt. and Golovin Bay, are of the race *pallidus*. The birds from the Point Barrow region are somewhat intermediate between *pallidus* and *s. johannis*, as they are acquiring some dark dorsal feathers, but on the whole they seem nearer to the Asiatic form and are, therefore, identified as such."

Inasmuch as the Golovin Bay bird, with the family of three young (nos. 22615-6-7) represents the first American breeding record of the Siberian Rough-leg, and *pallidus* may be the form breeding regularly along the shores of Bering Sea, it may be well to quote in part from my field notes: July 26—"Arrived at Golovin Bay early in the forenoon, and after breakfast went to the big bluff extending away from the village several miles. There were quite a number of passerine birds about, thrushes, longspurs and fox sparrows being especially noticeable. I covered the whole mountainside looking for ptarmigan, but did not see a sign. At least three pairs of Rough-legged Hawks must be breeding along the cliffs, and I found one pair, with three young in the nest. The youngsters were just beginning to get feathers along the scapulars. The nest was in a rather inaccessible place, and was composed of small twigs, placed upon a projecting rock. We located another pair of breeding hawks, but could not find the nest, as our time was too limited."

On my return from the North, the adult and young birds were exchanged with the Milwaukee Public Museum. When it was learned that these specimens represented breeding records for North America, the officials of that institution, Director Ira Edwards and Curator O. J. Gromme, suggested the birds should be returned to The Colorado Museum of Natural History to be kept with our rather extensive series of Alaskan birds. This gesture is typical of the friendly spirit of cooperation existing among museums of the United States.—ALFRED M. BAILEY, *The Colorado Museum of Natural History, Denver, Colorado.*

**Duck Hawk in Ohio.**—Records of the Duck Hawk in Ohio are sporadic and scattered and it is, therefore, the intent of this paper to combine as many of these as possible besides the addition of new records.

On October 4, 1940, a female Duck Hawk (*Falco peregrinus anatum*) was shot by Ohmer Earhart in central Williamsburg township, Clermont County, Ohio. The bird was an immature specimen. It measured but 15 inches in length; the wing spread was 30 inches. Feathers of the back and rump were a bluish-ash in color, but were tipped with a narrow margin of rusty-brown; ground color of the breast and belly was light buff with dark brown streaks on the shafts of the feathers, typical of a young falcon of this species. This is the first formal record of this bird in Clermont County. We tried in vain to locate other migrants of the Duck Hawk in the vicinity where this bird was taken. The specimen was mounted and added to the zoological collection of Miami University (Oxford, Ohio).

The following are most of the Ohio Duck Hawk records:

DATE	OBSERVER	LOCATION	REMARKS
Oct. 8, 1874	Charles Dury	Auglaize Co.	Two: male and female.
Sept., 1883	Charles Dury	Hamilton Co.	Juvenile.
Sept., 1901	W. L. Dawson	Columbus	One taken from University Building.
Mar. 6, 1902	W. L. Dawson	Columbus	Hunting low over north end of Columbus.
July 31, 1930	Dr. L. E. Hicks	Little Cedar Point	Chasing pigeons over downtown area.
Jan. 19, 1932	Louis W. Campbell	Toledo	One to three birds annually.
Feb., 1922— Feb., 1934	Milton B. Trautman	Buckeye Lake	
May 30, 1937	M. B. Trautman and Louis Campbell	Little Cedar Point	

DATE	OBSERVER	LOCATION	REMARKS
Feb., 1939	Chalmer Burns	Hoppe's Game Refuge Concord Twp., Fayette County	Adult Female.
Oct. 9, 1939	Louis Campbell	Little Cedar Point	Two.
Oct. 24, 1939	W. W. Marks	One of North Islands, Maumee Bay	Banded at Marquette, Mich. by W. S. Feeney.
Oct. 28, 1940	Wm. B. Hendershot R. Alloway	Game Refuge Indian Lake	

—HUBERT BEZDEK, *Ohio Division of Conservation & Natural Resources, Batavia, Ohio.*

**Whooping Cranes in eastern Colorado.**—Since there appears to be only one specimen record (and that of doubtful validity) and no recently published sight record of the Whooping Crane in Colorado, the following note is placed on record.

On October 13, 1941, Game Management Agent Frank F. Poley of the U. S. Fish and Wildlife Service, observed on the Kit Carson Refuge in Cheyenne County, Colorado, two large white birds with black-tipped wings which he believed to be Whooping Cranes. On that occasion the birds were flushed repeatedly and they traveled merely from one to the other of two bodies of water on the area.

On October 15, the writer accompanied Mr. Poley on another trip to the area and had no difficulty in identifying the birds as Whooping Cranes, *Grus americana*, with or without the help of nine-power binoculars. On this second day's visit although the birds could be approached no nearer than about 200 yards, they again were flushed from time to time and finally at about noon they rose to a great height and nearly disappeared from view, but, after a flight of twenty minutes, they returned to the shallow lakes.

On October 17 the writer, accompanied by photographer J. W. Jackson of Brush, Colorado, equipped with a camera having a 36-inch-focus lens, visited the area but, despite an all-day search, no Whooping Cranes were seen. Since a range-rider interviewed by Mr. Poley on the 13th said that the birds had been in the vicinity possibly four days before that time, it would appear that these Whooping Cranes had spent probably a week on this refuge area.

It is unusual and at the same time fortunate that these conspicuous migratory birds, so rare in Colorado, should have selected, out of more than 100,000 square miles comprising the area of the State, the only section of land which has been designated as a National wildlife refuge.—E. R. KALMBACH, *U. S. Fish and Wildlife Service, Denver, Colorado.*

**Long-tailed Jaeger in New Jersey.**—On September 28, 1941, a Long-tailed Jaeger (*Stercorarius longicaudus*) was seen at Cape May Point, New Jersey. The bird was observed from a boat rounding the inside corner of the point and was under observation several times. Once it was observed perched on a piece of driftwood which was riding on the waves, giving an exceptionally good view of the long, attenuated tail-feathers. Present at the time were three Parasitic Jaegers (*Stercorarius parasiticus*), and it was possible to note the smaller size of the Long-tailed Jaeger as well as the extreme difference in the length of the tails. The jaegers were harassing a flock of about two hundred terns which were milling about near the point.

Stone ('Bird Studies at Old Cape May,' 2: 523, 1937) states that there are no records of the Long-tailed Jaeger for New Jersey proper although Dr. Frank M. Chapman saw one 80 miles off Barnegat light, May 6, 1894. Therefore, it would seem that this constitutes the first recorded occurrence for the State. Had it not been for the passage offshore a few days previously of a tropical disturbance of hurricane proportions, it is unlikely that this bird would have been seen so near to shore. Indeed, it was so rough at sea on the day this bird was seen that it was not wise to venture very far offshore in search for pelagic birds and it is probable that most of them were near shore at any rate.

Among those who observed the bird were M. Albert Linton, Edward S. Frey, George W. Pyle, W. Roger Whitworth, Herbert S. Cutler, and the writer. The Long-tailed and the Parasitic Jaegers were observed independently from the shore on the same day by Joseph M. Cadbury.—ALBERT E. CONWAY, *West Chester, Pennsylvania.*

**Least Tern watering eggs: Gideon Mabbett's query.**—Dr. T. S. Palmer's obituary of Gideon Mabbett (Auk, 58: 613, 1941) mentions Mabbett's query (Auk, 410-411, 1890), about drops of water on the eggs of the Least Tern (*Sterna a. antillarum*). Some years prior to reading this query, about 1934, I too had been puzzled by the same thing. On several occasions drops of water had been found on tern eggs in the middle of a very hot day. It seemed the water must have been put on the eggs shortly before I arrived.

Mr. G. Robert Lunz, Jr., gave a clue to the solution of the problem a year or so later, by telling of watching a Least Tern come in to the nest, stand over the eggs, and shake water from her plumage, some of which naturally fell on the eggs. Since then, it has been noticed in the tern colonies on hot days, that there is a steady movement of terns out to the river where they dip the feet and lower belly in the water a time or so, then fly back toward the colony. During the very hot hours, the terns do not cover the eggs closely, but merely shade them from the hot sun. Probably this allows some little cooling from the breeze.

The origin of the practice may be merely the wish of the bird to cool herself. The function, as regards the eggs, may be to cool them, and perhaps to restore through absorption, some of the moisture lost by evaporation. The Black Skimmers, American Oystercatchers, Florida Nighthawks and Wilson's Plovers, using a similar nesting ground, all have eggs with much thicker shells, and may consequently have less evaporation. Abandoned eggs often dry up rather than decompose.—IVAN R. TOMPKINS, 513 East Duffy St., Savannah, Georgia.

**Notes on the Devil Owl.**—There are three American species of the genus *Asio*, the Short-eared Owl, the Long-eared Owl and the Devil Owl (*Asio stygius siguapa*). The last-mentioned is rare and little known, although it ranges from Mexico and the Greater Antilles south to northern Argentina. In Barbour's 'Birds of Cuba' (Mem. Nuttall Ornith. Club, no. 6, 1923) this owl is said to resemble in the field "an earless . . . Short-eared Owl," but those I have seen looked like a Long-eared Owl, the prominent ear-tufts rising straight from near the middle of the head. The bird presents quite a different appearance from illustrations in recently published works, which were drawn from skins by artists unfamiliar with the bird in life. I have taken the species on Gonave Island, Haiti (*A. s. noctipetens*) and on the Isle of Pines, and have seen living specimens of both adult and young in captivity.

The following is a description of a bird in juvenal plumage, taken alive in Cuba during the first week in January, 1941:—Top of head dusky, the feathers edged with whitish; facial disc sooty, freckled with white above and with a distinct crescent-shaped mark behind eye; ear-tufts small but apparent directly above the eyes; rest of upper parts dusky brown, regularly barred with whitish or buffy white, the wings blackish with ochraceous and buffy white spots and bars; under parts buffy white, regularly barred with light dusky; tail barred dusky and buffy white; iris yellow; bill horn-blue, the tip whitish; feet ash-gray.

Credit for the discovery of the first nest of the Devil Owl must go to my friend Gastón Villalba, of Havana, who after repeated inquiries was shown a nest on or about December 1, 1940, near Laguna la Deseada south of San Cristobal, Pinar del Rio. The two eggs were laid on the ground in the middle of a small clump of 'palmas canas.' The 'nest' was composed merely of a few shreds of palmleaf. Unfortunately the eggs were subsequently destroyed, probably by pigs from a nearby farm. I had previously been informed by some 'guajiros' both in Cuba and in the Isle of Pines that these owls nest on the ground, but did not believe them, and at the time suspected that the 'Carabo' (*Asio flammeus*) nested in Cuba.

Nests are now known of all but four Cuban species (*Chondrohierax wilsonii*, *Cyanolimnas cerverai*, *Ferminia cerverai* and *Dendroica pityophila*), although numerous others have not as yet been found breeding within the confines of the Republic.—JAMES BOND, Academy of Natural Sciences, Philadelphia, Pennsylvania.

**Saw-whet Owl in Centre County, Pennsylvania.**—On December 11, 1941, an adult female Saw-whet Owl, *Cryptoglaux acadica acadica*, was found wounded, by Mr. T. R. Legler near Snowshoe, Centre County, Pennsylvania. According to 'The Birds of Western Pennsylvania' by W. E. Clyde Todd, this is the first record for Centre County, although the species has been taken in adjacent counties. This specimen was in excellent physical condition and has been placed in the ornithology collection of The Pennsylvania State College.—MERRILL WOOD, The Pennsylvania State College, State College, Pennsylvania.

**Autumnal display of northern Downy Woodpecker.**—While traversing the Spellacy Valley in Holmes County, Ohio, on October 20, 1940, my attentions were diverted to the activities of a male and female Northern Downy Woodpecker (*Dryobates pubescens medianus*). Stationed on a limb, head to head, they appeared to be engaged in courtship activities. The male was displaying before the female and in doing so he kept his head raised at a considerable angle to the long axis of his body. All the while he would flip his wings sharply, while he kept his tail fanned out. At times there was a slight weaving motion of the head, but it was not a conspicuous part of the display. The female, in the meantime, received the affections of the male in a somewhat passive manner, although she occasionally flipped her wings. No sound was made by either bird, and they would remain on the same branch for perhaps a minute, then they would fly to another tree, and there repeat the performance. The female always made the first move to another perch.

On referring to Bent's 'Life Histories of North American Woodpeckers' (1939), I find that he alludes to similar activities of two Downy Woodpeckers, but in this case both birds were females. What can be the significance of such behavior?—EDWARD MACARTHUR, Cleveland, Ohio.

**Vagrant occurrences of *Tyrannus melancholicus* in North America.**—The range of the species *Tyrannus melancholicus* lies principally south of the United States in Mexico and Central and South America, although the race *couchi* (Baird) has long been known to breed in the valley of the lower Rio Grande in Texas, and the recent report of Philips (1940) has established *T. m. occidentalis* Hartert and Goodson as a sparse breeder about Tucson, Arizona. North of the two last-named localities the species has been known only from three vagrant occurrences in the States of Maine and Washington, and the Province of British Columbia. The present paper is intended to report a fourth such occurrence, and to review and correlate all the known far-northern records of this essentially neotropical species. The author wishes to express his thanks to Dr. F. C. Lincoln of the U. S. Fish and Wildlife Service for his critical reading of the manuscript.

While examining the collection of the late D. E. Brown at the Washington State Museum the writer found a specimen of the West Mexican Kingbird (*T. m. occidentalis*) incorrectly identified as an Arkansas Kingbird (*Tyrannus verticalis*). The bird was a young male taken November 26, 1927, at Westport, Grays Harbor County, Washington, by Brown, and reported (Brown, 1928) as a probable first collection of *verticalis* in western Washington, although there are actually several earlier records in print (e. g. Rathbun, 1927, p. 32; Baird, Cassin, and Lawrence, 1858, p. 174). It has a recorded length of 8.25 inches, additional measurements being as follows: wing, 106.8 mm.; tail, 83.6; bill, 24.2. Obvious juvenile characters are the very slight development of the crown-patch, and the absence of the primary emarginations typical of adults of the genus. The subspecific identification, later confirmed by Dr. Herbert Friedmann of the United States National Museum, was determined with the assistance of Martha Reekie Flahaut of the Washington State Museum, and of Stanley G. Jewett of the U. S. Fish and Wildlife Service, who kindly loaned specimens for comparison. It is with the permission of Mrs. Flahaut that the record is published at this time.

Previously, the West Mexican Kingbird has been included in the Washington State list on the basis of "a male of the year . . . collected by Carl Lien in 'Jefferson County,' Washington, on November 18, 1916 . . . now no. 22,269 of the Dickey collection. . . . It was labelled by the original collector as 'Ash-throated Flycatcher'" (van Rossem, 1929). Correspondence with Mr. Lien, now at the Point Wilson Light Station, Port Townsend, Washington, has served to fill in some of the blanks in our knowledge of this important record. He writes (March 27, 1941): "I started collecting in 1915 at the instigation (and prodding) of my friend Geo. Cantwell, then with the Biological Survey, and hence, in 1916, when this specimen was taken, I was not too certain of its identity. However, all birds taken and labelled as from Jefferson County were taken on Destruction Island, which lies off the west end of this county. I have no recollection of [the capture of] this particular specimen, but nearly all land birds taken there were among those striking, or bewildered by, the light." The omission of this specimen from a list of birds killed at the Deception Island Lighthouse in 1916, published by Mr. Lien (1923), is probably accounted for by his uncertainty as to its proper identification. Destruction Island is about sixty miles north along the Washington coast from Westport, and the specimens from these two localities correspond closely with each other in that both are immature males taken in the month of November.

The species *T. melancholicus* is included in the Canadian list of birds on the basis of a single specimen, collected February, 1923, at French's Beach, Vancouver

Island, by J. G. French, and reported (Kermode, 1928) as a "Lichtenstein Kingbird, *Tyrannus melancholicus satrapa* (Cabanis and Heine)." Logically this record should, like the others in the Northwest, be referable to the race *occidentalis*, as van Rossem (*op. cit.*) has pointed out. Through the kindness of Dr. Ian McTaggart Cowan, of the University of British Columbia, the specimen in question was submitted to Dr. Friedmann, who verified our belief in pronouncing it *occidentalis*. Dr. G. Clifford Carl, Acting Director of the Provincial Museum at Victoria, has given permission for publication of this revision, which necessitates a change in the Canadian list. Like the other two northwestern records, the present one is based on a juvenile taken on the ocean coast; but it differs somewhat in being a winter rather than an autumnal bird, and of undetermined sex. Dr. Cowan informs me that French's Beach is near Sooke, on the south end of Vancouver Island, approximately 60 and 120 miles north and east of the two Washington localities.

Besides the three records for the Pacific Northwest there seems to be but one other far-northern occurrence of *Tyrannus melancholicus* reported: that of a specimen taken at Scarborough, Maine, October 31, 1915 (Norton, 1916). This bird was originally determined as of the race *satrapa*, but subsequent changes in nomenclature render this name obsolete and the identity of the Scarborough specimen uncertain. The A. O. U. 'Check-list' (1931: 202) identifies it logically with *T. m. chloronotus*, and the correctness of this has been confirmed by Dr. Friedmann, who examined the bird through the kindness of Arthur H. Norton of the Portland Society of Natural History. It is notable that here again the record is based on an immature male taken in autumn near the ocean coast, although in this case the specimen was of a different race and was taken on the opposite side of the continent from the three northwestern records.

Some explanation is usually invoked to account for accidental or vagrant occurrences of the type considered above. Many tyrannids, as well as birds of other groups, are noted for their propensity to wander far from their normal ranges, but *Tyrannus melancholicus* has not generally been accounted one of these (Taverner, 1934: 289). Kermode (*op. cit.*) thought the specimen reported by him might have obtained passage on a steamer, and Norton (*op. cit.*) evidently felt that southern cyclones might have driven his specimen north; but it seems at least equally likely, with the above correlations in mind, that in the juvenile males (and perhaps in both sexes) of at least two of the named races of this species there is a tendency to wander northward along the ocean coasts in fall and winter.

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-JOHN W. SLIPP, Washington State Museum, Seattle.

**Tree Swallow breeding in northeastern Louisiana.**—On June 20, 1941, while engaged in field work in the Delta region of Mississippi, a brief survey was made of the bird life of Eagle Lake, a narrow crescent-shaped body of water lying approximately sixteen miles northwest of Vicksburg. Although for the time being at least a lake in all its characteristics, this stretch of water was originally part of the Mississippi River. It was isolated some years ago when the river cut a new channel a few miles away, and in years of normal rainfall that followed this change, the depth of the water gradually increased. This resulted in the submersion and death of the trees that at one time grew at the edge of the water, and their present status as old decayed stubs dotting much of the shore line on the western edge of the lake. The presence of several Tree Swallows (*Iridoprocne bicolor*) here at this late date in June aroused the suspicion that they might possibly be breeding birds, so the stubs in the vicinity of where these birds were first seen were closely scrutinized. Within a few minutes a nest was found that held three almost fully fledged young. The nest was in a cavity up ten feet from the water, in an old stub possibly a hundred yards from the nearby shore. Further search failed to reveal another nest, but as three adult birds were on several occasions in sight at one time, feeding over the water, at least two pairs of these swallows were nesting at this spot. Eagle Lake is locally considered to be in Mississippi, but reference to available maps shows the line separating Mississippi and Louisiana to be in the middle of the lake. Accordingly these Tree Swallows, nesting as they did near the western shore, must be credited to the list of birds now known to breed in Louisiana. The 1931 'Check-list' gives the range of this species as breeding south to northeastern Arkansas and Virginia, so this marks a considerable extension in the now accepted breeding range of the Tree Swallow in the Southeast.—THOS. D. BURLEIGH, Gulfport, Mississippi, and MERRIAM L. MILES, Vicksburg, Mississippi.

**Identity of *Parus frigoris* Selys.**—Nearly a hundred years ago de Selys-Longchamps named and described (Bull. Acad. Roy. Sci. Bruxelles, 10: (Séance 8 juillet) 27, 1843) by comparative characters a chickadee from, as he believed, "Iceland." The following is a translation:

"I possess an individual which I am assured was brought from Iceland by the French scientific expedition. It does not differ appreciably from those from Canada in color, save that the black of the throat is less extensive laterally

[this is due to the preparation]—the back is more olivaceous, approaching that of *palustris*, and the posterior under parts are more reddish; but the dimensions are greater (total length, 4 inches 10 lines; of the tail, 2 inches 6 lines). If these characters and dimensions are constant, they may form a distinct species under the name *Parus frigoris* Nob."

At a much later date (Bull. Soc. Zool. France, 9: 54, 1884) he corrected the locality to the "Etats-Unis" and tentatively placed his *frigoris* with *atricapillus* "Race *septentrionalis*" because of the "long tail." However, he re-affirms his color characters.

When in Brussels in July 1939, I was courteously given access to the Selys collection which is, or was at that date, housed in the old Selys residence a short distance from the Musée Royal d'Histoire Naturelle. My notes taken at the time of the examination of the type of *Parus frigoris* are as follows: "So far as I can see, this bird is simply *atricapillus*, a little more richly buff on the sides and under tail-coverts and as regards [restriction of] wing and tail edging. The original description mentioned the unusually reddish character of the under parts and the more olive [less grayish] tone of the back. The supposed restriction of the throat patch is partly due to fresh plumage and partly to the posture of the mount. At any rate, this specimen has nothing to do with *septentrionalis* where tentatively placed by Hellmayr (Das Tierreich, 18: 56, 1903). Immediate comparison is limited to a couple of birds from New York."

As to other data relative to the type, it is a mounted bird in good condition, a fully plumaged adult with but slight wear apparent. Three Selys numbers are on the stand, 18, 858, and 1076, the last a printed label pasted on. On the rim of the stand is written in pencil "*frigoris*." The old Selys tag attached reads: "Parus (Poecile)/*atricapillus*. L./Race/*septentrionalis* Harris/type du *P. frigoris* Selys/Etats Unis atlant.". Measurements of wing, tail, and exposed culmen are 67, 62, and 8.0 mm., respectively. Incidentally, it is obvious that Selys's idea of *frigoris* as a long-tailed race was gained partly from the rather elongated manner in which the specimen is mounted and partly by the slightly smaller size of his limited comparative material. His tail measurement of "2 inches 6 lines" was taken in a manner impossible to judge and may have been from the uropygium instead of from the point of insertion of the central pair of rectrices. Assuming that he used the Pied du Roi his measurement approximates 67 mm., a circumstance which favors the former method; if he used the English foot it would be 63 mm., and the latter method is indicated!

Recently, Aldrich and Nutt (Sci. Publ. Cleveland Mus. Nat. Hist., 4: no. 2, 29, 1939) have characterized and named as *Penthestes atricapillus bartletti* the Black-capped Chickadee of Newfoundland on precisely the color differences shown by the type of *Parus frigoris*. The wing length of the type is also distinctly in favor of the Newfoundland race as given by Aldrich and Nutt. Unfortunately our bill measurements are not comparable. All things considered it would seem that the name of the Newfoundland Black-capped Chickadee should be *Parus atricapillus frigoris* Selys.—A. J. VAN ROSEM, University of California, Los Angeles, California.

Nomenclature of certain Pycnonotidae.<sup>1</sup>—Among the scattered manuscript notes of the late Charles W. Richmond deposited in the United States National Museum, I have recently uncovered the following observations which seem not previously to have been brought to public attention:

<sup>1</sup> Published with permission of the Secretary of the Smithsonian Institution.

*"Ixos Temminck"*

"Temminck establishes his section "Turdoïde" or "les Turdoïdes" in Livr. 12 [vol. 2] of the Pl. Col., and designates as type the *Turdus phoenicopterus*. Later (Pl. Col. livr. 64), he gives the name *Ixos* to this section. The type of *Ixos* should, therefore, be *T. phoenicopterus*, which is a *Campéphaga*, and *Ixos* thus becomes a synonym of *Campéphaga* (Vieillot, 1816).

Cretzschmar uses *Turdoïdes* in a generic sense for a *T. leucocephalus* (now a *Crateropus*), but later comes back to *Ixos*. His use of *Turdoïdes* is in a Temminckian sense and is synonymous with *Ixos*. . . ."

Reference to Temminck's remarks in the text accompanying pl. 274 (*Turdus azureus*), pl. 71 (*Turdus phoenicopterus*), and pl. 382, fig. 1 (*Ixos virescens*) and to the 'Tableau méthodique' (where for the first time we find the combination *Ixos phoenicopterus*, with the footnote, "Ces espèces portent dans le texte des Planches Colorées le nom de *Turdus*, qu'il faut changer contre *Ixos*'), makes it certain that Richmond's view is correct and that Oberholser (Proc. Acad. Nat. Sci. Philadelphia, 1899, p. 212), while right in stating that characters are given for the genus, is wrong in believing that "the only species given is *Ixos virescens* Temminck, which must therefore be considered the type." The name *Ixos*, accordingly, cannot be used for a pycnonotine genus.

In examining some fifty recognizable forms variously placed by recent authors in the genera *Microscelis* Gray 1840, *Iole* Blyth 1844, *Hemixos* Blyth 1845, *Ixocincla* Blyth 1845, *Tricholestes* Salvadori 1874, and *Haringtonia* Mathews & Iredale 1917 (new name for *Hypsipetes* Vigors 1831, not *Ypsipetes* Stephens 1829), I have been quite unable to discover characters which might be used to separate any one group from those others most nearly related and suggest that what seems to be scientific fact will be best served by placing all under the oldest name, *Microscelis* Gray 1840 (genotype: *Turdus amaurotis* Temminck).

Such procedure makes necessary a series of changes in connection with the names *olivacea* (used twice) and *virescens* (used three times). *Iole olivacea* Blyth 1844 is preoccupied by *Hypsipetes olivacea* Jardine & Selby 1837. The next oldest name in the specific group, *Iole virescens* Blyth 1845, is preoccupied by *Ixos virescens* Temminck 1825. The third oldest name is either *Iole viridescens* Blyth, published in 'The Ibis' for January 1867, or *Criniger charlottae* Finsch, published in the 'Journ. f. Ornith.' for January 1867. Since I have not been able to obtain more definite information on the dates of appearance of these two names, I here arbitrarily select *charlottae* as the older, which then becomes the specific name, while *viridescens* becomes the proper name for the subspecies of Arakan.

The race of *Microscelis charlottae* found in Sumatra and the Malay States is left without a name unless *Trichophorus brunneascens* Finsch 1867, a 'still-born synonym,' be considered to have acquired nomenclatural standing by Chasen's action in placing it in synonymy with *Iole olivacea* Blyth 1844 (with full bibliographic references) and restricting the type locality to Sumatra by implication (Handlist Malaysian Birds, 1935, p. 193).

*Ixocincla virescens* Blyth 1845 of the Nicobar Islands (which I retain as a full species) will be known as *Microscelis nicobariensis* (Moore) 1854.

Taking a broad view of what is embraced by the 'species,' I would place in the genus *Microscelis*, as here conceived, the following, in what seems to be a natural sequence from the most to the least specialized:

1. *M. madagascariensis* (including *Ixocincla borbonica* and *I. crassirostris* of the 'Systema Avium Ethiopicarum' and *M. psaroides* of the 'Fauna Brit. India, Birds,' 2 ed.).
2. *M. leucocephalus.*
3. *M. amaurotis.*
4. *M. siquijorensis.*
5. *M. everetti.*
6. *M. rufigularis.*
7. *M. philippensis.*
8. *M. striaticeps* (not seen).
9. *M. nicobariensis.*
10. *M. virescens* (including *Ixos malaccensis* and *I. mcclellandii* of the 'Handlist Malaysian Birds').
11. *M. flava* (including *Ixos cinereus* of the 'Handlist Malaysian Birds' and *I. castanonotus* and *I. canipennis* of 'Les Oiseaux de l'Indochine Française').
12. *M. criniger.*
13. *M. icterica* (not seen; possibly conspecific with the last).
14. *M. charlottae.*

—H. G. DEIGNAN, U. S. National Museum, Washington, D. C.

New records of the Colima Warbler from Mexico.—Specimens of the Colima Warbler (*Vermivora crissalis* Salvin and Godman) are still not so common but that its occurrences in new areas should be recorded. Two individuals have been added recently to the Moore Collection, both of them taken by Chester C. Lamb, one an adult male secured on November 12, 1934, at Rancho Batel, five miles due north of Santa Lucia, Sinaloa, Mexico, at an altitude of about 5200 feet; and the other, a second adult male, taken on November 3, 1941, at Sierra Ozumatlan in northeastern Michoacan, Mexico, at an altitude of approximately 9500 feet. Both birds have acquired their winter plumage, the feathers being unworn, but the former one (no. 12592 Moore Collection) has lost all of its rectrices. The latter one (no. 30355 Moore Collection) is in perfect condition. The specimen from Sinaloa is the first record for that State, and the Michoacan one seems to be the most southeastern locality at which the Colima Warbler has been taken.—ROBERT T. MOORE, California Institute of Technology, Pasadena, California.

Louisiana Water-Thrush breeding in Essex County, New York.—According to Eaton's 'Birds of New York' (1912) the Louisiana Water-thrush (*Seiurus motacilla*) breeds as far north as the southern end of Lake George. On June 7, 1941, during a search along boulder-strewn, rushing streams, I found two pairs along the Warren-Essex County boundary, one pair within Essex County at an altitude of 800 feet. On June 9, I found a pair with young at Port Henry, in central Essex County.—GEOFFREY CARLETON, The Library, City College, New York City.

Redstart breeding in Worcester County, Maryland.—The Redstart (*Setophaga ruticilla*) occurs only rarely as a breeding bird in the Atlantic coastal plain. Dr. Stone ('Bird Studies at Old Cape May,' 2: 847, 1937) cites two breeding records for the coastal plain of New Jersey. However, it is not until one gets into the higher wooded hill country of the Piedmont province that one finds it breeding regularly, although there are a few breeding localities situated at the edge of the fall-line such as those in the Wissahickon and other valleys in and around Philadelphia.

On June 20, 1941, Mr. Arthur Sigman called my attention to a nest of the Red-start which was situated in a red-maple tree (*Acer rubrum*) a few feet from the banks of the Pocomoke River, in Worcester County, Maryland, and a short distance northeast of the town of Willards. The nest was situated about twenty feet from the ground in a rather substantial fork of the tree and contained several half-grown young. Due to the pressure of time, it was not possible to climb the tree to make a closer investigation or to take photographs. The male bird sang his characteristic song and busied himself with the presence of the observers, while the female was seen feeding the young. Nesting nearby were several other species of warblers including the Prothonotary (*Protonotaria citrea*), Parula (*Compsothlypis a. americana*), and Yellow-throated Warblers (*Dendroica d. dominica*), the Louisiana Water-Thrush (*Seiurus motacilla*), and the Maryland Yellow-throat (*Geothlypis t. trichas*).—ALBERT E. CONWAY, West Chester, Pennsylvania.

**Two little-known birds from eastern Brazil.**—Among a collection of birds made by Ernest G. Holt in Ceará and Espírito Santo, Brazil, while engaged in the Rockefeller Foundation's investigations of yellow fever, are two species that call for special mention as the specimens yield additions to our knowledge.

*Thamnophilus caerulescens caerensis* (Cory).

This subspecies, hitherto known (at least in published information), from the unique type (male), is represented by a small series from the type locality. The birds have been identified by direct comparison with the type, with which they agree in the characters given by Cory. Inasmuch as the female has not been known before, the following description may serve to fill this gap:

Similar to the female of the typical race (specimen from Itatiba, São Paulo, used for comparison) but with larger, stronger bill, the crown and occiput lighter and brighter—between Sudan Brown and Antique Brown (as opposed to Dresden Brown); lores, cheeks, and auriculars very slightly paler, clearer gray; the under parts paler, less ochraceous tawny (Honey Yellow darkening on the breast and flanks to between Isabella and Yellow Ochre); the rectrices more suffused with Buffy Citrine, except for their terminal fifths, which are Deep Neutral Gray tipped with white; and the upper wing-coverts Deep Neutral Gray broadly edged with Medal Bronze and with no white terminal spots.

Measurements of the present series are as follows:—5 males: wing, 67–71 (69.6) mm.; tail, 55–61 (58.8); culmen from base, 19–20 (19.4); the type (male):—wing, 70; tail, 57+; culmen from base, 20.5; 2 females:—wing, 68.5–70; tail, 56.5–59; culmen from base, 19–20. Two of the males and one female have been presented to the U. S. National Museum.

*Turdus albicollis crotopezus* Lichtenstein.

According to Hellmayr (Cat. Birds of the Americas, pt. 7, p. 368, 1934), this race of the White-necked Thrush is known only from Bahia trade-skins. It is, therefore, of interest to find that birds referable to this race occur in Espírito Santo. Holt obtained three birds (a male and two females) at Pau Gigante, in September and October, 1940, which agree quite well with a specimen of *crotopezus* from "Bahia." The agreement is not perfect; the Espírito Santo are a little less rufescent on the back, and they have the axillaries and under wing-coverts a little more ochraceous. One of the males has the sides and flanks tawnier than the others, thereby approaching typical *albicollis*, which is not surprising, as the latter is the

form found at Rio de Janeiro, not so far to the south.—**HERBERT FRIEDMANN, U. S. National Museum, Washington, D. C.**

**An Albino Chipping Sparrow.**—An entirely white bird was observed in a flock of Chipping Sparrows, *Spizella passerina passerina*, on September 18, 1940. The sparrow was feeding on the lawn and gave us every opportunity to observe it. The entire plumage was white; the bill pink. The sky was heavily overcast at the time and in the subdued light the eyes appeared dark. Except for color, it checked exactly in size and form and in flight, feeding habits, alertness, and other activities with the Chipping Sparrows with which it associated. Apparently it was a true albino.

The bird was observed in the neighborhood several times between about the middle of September and October 7, when last seen. It was seen by at least nine different people in the immediate neighborhood, which comprises five homes along a country road over a distance of about 300 yards. These homes are surrounded largely by cultivated and pasture land. None of the observers has been able to determine the eye color definitely. Probably it was a member of a local brood as the birds seemed to have definite feeding areas in the neighborhood. This white individual seemed to be accepted on an equal footing with other birds of the flock.—**O. M. AND H. L. SWEETMAN, Massachusetts State College, Amherst, Massachusetts.**

**Records from Lower California, Arizona, Idaho and Alberta.**—During the course of routine work on the collection and distribution records of North American birds of the United States Fish and Wildlife Service I have discovered a few unpublished items that seem significant enough to put on record. These are as follows:

*Spizella breweri breweri*.—In the Biological Survey's collection there are six specimens of Brewer's Sparrow from Lower California collected in July. These apparently are significant because of the fact that there are no published breeding or even summer records for this species from Lower California. Grinnell (Univ. California Publ. Zool., 32: 167, Nov. 6, 1928) states that it is only a winter resident throughout the entire area of this northwesternmost part of Mexico. However, the skins establish that Brewer's Sparrow is at least a casual summer visitant if it does not actually breed in northern Lower California. The specimens, collected by E. W. Nelson and E. A. Goldman at Piñon on the west slope of the San Pedro Martir Mountains, are as follows:

No. 197307, July 9, 1905, immature male

No. 197313, July 10, 1905, adult female

and those collected by them at Vallecitos in the San Pedro Martir Mountains are:

No. 197322, July 17, 1905, immature female

No. 197316, July 15, 1905, immature unsexed

No. 197317, July 15, 1905, adult female

No. 197319, July 15, 1905, adult male

*Spizella breweri taverneri*.—The range of the Timberline Sparrow, described by Swarth and Brooks (Condor, 27: 67-69, March 15, 1925), is very little known. There have been a few recent records adding to the known distribution (Auk, 53: 92, 1936; Auk, 45: 509, 1928; Condor, 34: 231, 1932; Condor, 37: 178, 1935; Condor, 40: 86, 1938) of this race, and to these can be added the male specimen collected in

[Auk  
April]

Smoky Valley fifty miles north of Jasper House in central western Alberta on August 26, 1896, by J. A. Loring and recorded by E. A. Preble (North Amer. Fauna, no. 27: 440, October 26, 1908) as *Spizella breweri*. The specimen, No. 155779, was identified as *Spizella breweri taverneri* by Dr. Harry C. Oberholser.

*Amphispiza bilineata deserticola*.—So far as I have been able to ascertain there is no published record of the Desert Sparrow from Idaho. This perhaps is due to the lack of field work in that State. In his unpublished field notes in the files of the United States Fish and Wildlife Service, L. E. Wyman says: "Desert Sparrows noted and identified but once near Ellis. One secured out of a party of four." This specimen, no. 239440, a male in worn plumage, collected by L. E. Wyman on June 25, 1912, at Ellis in the Pahsimeroi Valley in central Idaho, represents a substantial extension of range northeastward for this species. Gabrielson and Jewett (Birds of Oregon, Ore. State Monographs, Zool., no. 2: 565, March, 1940) have recorded several from southeastern central Oregon.

*Dumetella carolinensis*.—Although there are published records of the occurrence of the Catbird in Arizona (Condor, 37: 81, March, 1935) I feel that it is best to add these additional records because I believe they are the first specimens of this species collected in that State. E. A. Goldman in his unpublished field notes says: "A few seen in the timber along the Little Colorado River, June 7 to 10, 1915," and H. H. T. Jackson, who was with Goldman on that same trip, in his field notes says: "Three or four pairs of Catbirds were noted in the timber along the river. A male specimen, no. 285337, was taken by Goldman." This specimen was collected at Springerville in central eastern Arizona at an altitude of 6,900 feet on June 7, 1915. In the Tunitcha Mountains, on Wheatfield Creek, at an elevation of 7000 feet in northeastern Arizona, Paul E. Trapier collected a female Catbird, no. 299738, on June 25, 1927.—ALLEN J. DUVALL, U. S. Fish and Wildlife Service, Washington, D. C.

## RECENT LITERATURE

"The Handbook of British Birds." Vol. 5.—In spite of war and its attendant difficulties, the fifth and concluding volume<sup>1</sup> of this splendid manual is now issued, containing the remaining orders of British birds, the Charadriiformes, Ralliformes, and Galliformes. The treatment, as before, includes a terse statement of the characters, external, skeletal and muscular, of the orders and families, with condensed descriptions of the genera and species, their plumages, habitat, field characters, voice, display, breeding, food, distribution in the British Isles and abroad and their migration as well as notes on allied palaearctic forms. In the preparation of these accounts, a vast amount of literature has been surveyed and the important points brought out, while in the making of the plumage descriptions much material has been critically gone over. Final chapters include corrections and additions to all the volumes, drawn from lately published sources or recent observations by the authors; and at the end is a chapter listing all the species certainly accredited to the British Isles, 520 in number, with a brief summary statement of the occurrence of each. The index covers the entire five volumes. The twenty-two plates, most of them in color, illustrate the greater part of the species, often with two sets of figures to show summer and winter plumages and those of young or immature stages. In addition there are sixty-two text-figures giving details of bills, feet, or points of plumage difference between closely allied birds, so that the whole brings together within relatively small compass the important characteristics of structure and behavior of the sundry species that visit the British Isles.

But the work will not only be of value to European students, but also, since many of the species occur in America as well, it will prove of increasing value to ornithologists on this side of the Atlantic with its fund of well-selected information on many matters of importance, especially on plumages, habits and distribution, as well as on comparison with other closely allied forms. A careful reconsideration of various points in nomenclature has resulted in the adoption of several changes not incorporated in the A. O. U. "Check-list," including the following. For the Arctic Tern, the name *Sterna macrura* is used in place of *S. paradisaea*, the application of which is doubtful; *Larus argentatus smithsonianus* is regarded as "barely separable" from British birds of the typical race; for the Iceland Gull, *Larus leucopterus* is regarded as an indeterminate name, and *L. glaucoides* Meyer is adopted instead; the Black Guillemot is placed in the genus *Uria*, with the murres; while the ralline birds, following the researches of Lowe, are accorded ordinal rank, Ralliformes, distinguished by the structure of their feathers and their pterylosis. In the distribution of the Ivory Gull on the western side of the Atlantic, the 'Additions' might have given New Jersey instead of Long Island Sound as the farthest-south record (see Auk, 57: 403, 1940). One may express admiration of the British spirit not only for the thorough way in which the authors have cooperated to prepare this great work but in their success in launching it during years of war.—G. M. ALLEN.

<sup>1</sup> Witherby, H. F., Jourdain, F. C. R., Ticehurst, Norman F., and Tucker, Bernard W. The Handbook of British Birds. Volume 5. 8vo, xii + 356 pp., 22 pls., text-figs., maps, 1941. H. F. & G. Witherby, Ltd., 326, High Holborn, London. Price 25 shillings.

**Witherby's 'Check-list of British Birds.'**—This useful handlist<sup>1</sup> includes 520 species and races of birds "fully admitted to the British List," 424 of which are species and 96 are races. Of these, 147 are resident in the British Isles while 52 are regular summer visitors that breed; twenty others have bred occasionally within the past century, thus making a total of 219 birds that are known to breed within the area. In addition, 82 are regular winter visitors or "passage migrants," while 238 are included in the large class of occasional and irregular visitors. One, the Great Auk, is extinct. It is interesting that so large a portion of the 520 birds is made up of the rarer visitors of which some forty or more are American species. It is natural that about three-fourths of these latter are water- or shorebirds that breed mostly in the northern regions of America.

For each species or race, the accepted Latin and English names are given with a very brief statement of the manner of occurrence. These occupy the left-hand pages while the right-hand pages are left blank as a convenience for manuscript notes and additions of the user. It might in a few cases have been better to use the vernacular names of American species as provided in the A. O. U. 'Check-list,' although in others the English usage is undoubtedly to be preferred. Thus "Yellowshank" for our Lesser Yellowlegs undoubtedly is in keeping with British usage but Wilson's Snipe is preferable to American Snipe. On the other hand Kestrel is better for the Sparrow Hawk, since the latter term has long usage in the British Isles for an *Accipiter*, and Nightjar is better than Nighthawk, since the bird is not a hawk at all. An improvement is doubtless the reduction of our Semipalmated Plover to the rank of a subspecies of *Charadrius hiaticula*, but the Latin names of some of the redpolls have an unfamiliar look to an American. The names are compiled from the new 'Handbook of British Birds' in which the details are more fully given concerning such changes.—G. M. ALLEN.

**Dr. Blanchard on the Annual Cycle of White-crowned Sparrows.**—This important paper<sup>2</sup> gives a detailed account of the behavior of two races of White-crowned Sparrow on the Pacific coast, *Zonotrichia leucophrys nuttalli*, which is the resident subspecies about Berkeley, California, and *Z. l. pugetensis* which breeds from northern California northward into southern British Columbia. Together they occupy a narrow but continuous band along the shore line and are separated from other races. The Puget Sound race is migratory and occurs with the Nuttall's Sparrow as a winter resident at Berkeley. The case is therefore an excellent one for the investigation of varying behavior within a single species. During the non-breeding period the Nuttall's Sparrows remain on their territories but are tolerant of the wintering groups of their own and the visiting race.

In late September and early October the Puget Sound Sparrows reach Berkeley and may be distinguished in the field by a paler plumage and slightly different song. The two races live peaceably together until the first of the year, when the resident birds become more zealous in protecting their individual territories and fighting off others of the species. The more northerly race does not migrate until late March and early April, and soon thereafter was found arriving on its breeding grounds. Careful studies were made of the two races in the field and in the labo-

<sup>1</sup> Witherby, H. F. A Check-list of British Birds with a short account of the status of each (revised edition). Compiled from "The Handbook of British Birds." 8vo, 78 pp., 1941; H. F. & G. Witherby, Ltd., 226, High Holborn, London. Price 5 shillings.

<sup>2</sup> Blanchard, Barbara D. 'The White-crowned Sparrows (*Zonotrichia leucophrys*) of the Pacific seaboard: environment and annual cycle.' Univ. of California Publ. in Zool., 46: 1-178, 20 pls., 50 text-figs., Nov. 1941.

ratory, and individual banded birds were followed in their activities from year to year. The rate of enlargement and ripening of the testes and the laying on of fat by the migratory race are shown to be different from these phenomena in the resident form, indicating internal responses of a different nature. The study shows that *pugetensis*, the migratory race, differs in various points. Thus it shortens the period of territorial establishment which in *nuttalli* is finished from 6.5 to 8.5 weeks before the first day of incubation and omits the subsequent period of 46 to 59 days between cessation of chasing and fighting and the first day of incubation. Again, the interval between completion of the first nest and laying of the first egg is a day shorter in *pugetensis*, while the interval between the fledging of one brood and laying the first egg for the next is reduced to nine instead of twenty days. On the other hand the more northern bird averages 4.09 eggs to a set against 3.25 in the southern race. The active part of the reproductive cycle is thus less than two-thirds of the time required by the populations of central California with a total difference of nearly two months. All this indicates that the northern breeding population is now physiologically an altogether different race from the more southern *nuttalli*, although the morphological distinction is a matter of slight degree.

The paper includes a vast amount of data, the result of several years of intensive study of the habits of the two races in the field, the macroscopic and microscopic changes in the testes of the two races and the correlation of these with migration, together with various theoretical considerations. Indeed the wealth of detail and the rather difficult style of writing make the story a little hard to follow in places so that one misses a good general summary of the entire discussion, yet realizes that the author has presented a very careful and suggestive piece of work that is of high value.—G. M. ALLEN.

Perry on the effect of adrenalin on the reproductive cycle.—In this important paper<sup>1</sup> the author sets forth a tentative explanation of the annual ripening of the gonads with daily increase of light, an effect which, as is now well known, may be produced experimentally by subjecting birds at off seasons to a gradually longer and longer day. In the series of experiments here described, immature English Sparrows in Ohio, were given, from December to March, an increasing daily dosage of artificial light in two lots, for forty and sixty days, respectively. By this time the males had developed fully black bills and the testes showed advanced stages of spermatogenesis, while the females, although less advanced, showed a stage considerably beyond that of quiescent birds. Half the birds of the two lots were then separated as controls, while the others were given daily injections of one-half minim doses of adrenalin and then returned to their dark cubicles. It was found that in from fifteen to twenty days the males had lost practically all the black of the lower bill and that of the upper bill was paler as in non-breeding birds, while the gonads had regressed to some four per cent of their previous volume; and in the females the ovary had diminished to slightly less than in the normal bird.

In the second series of experiments, birds in February were brought to breeding condition by daily injections of antuitrin (the gonad-stimulating principle from the anterior lobe of the pituitary). When the bills of the males had become completely black (indicative of ripened gonads) half-minim doses of adrenalin were given, and on alternate days, doses of antuitrin, using normal daylight hours. At

<sup>1</sup> Perry, James C. "The antagonistic action of adrenalin on the reproductive cycle of the English Sparrow, *Passer domesticus* (Linnaeus)." *Anat. Record.* 79: 57-77. 3 pls., Jan. 25, 1941.

the end of the experiment, the gonads had regressed to the quiescent state, as if an antagonistic effect of adrenalin over antuitrin. Histological conditions were corresponding. In the third set of experiments, juvenile birds in the quiescent state were similarly injected on alternate days with antuitrin and adrenalin. After sufficient antuitrin had been given to have caused the birds to become black in the bills if antuitrin alone had been used, it was found that their gonads were in the typical quiescent state. Again adrenalin seemed to have inhibited the gonadotropic effect of the antuitrin. In the final series of tests, daily injections of adrenalin were given at the time of the natural breeding season beginning in early April, and the birds were exposed to normal daylight hours. Controls were held under similar conditions, but were not treated with adrenalin. The result was that the birds given adrenalin showed regression of the testes amounting to about 95 per cent in weight and 92 per cent in volume as compared with the controls, and there were corresponding histological aspects.

The author concludes therefore that adrenalin is antagonistic to the gonadotropic hormone, the failure of which is thus responsible for the regression of the secondary sex character of black bill, as well as for that of the gonads. In light-stimulated birds, adrenalin causes regression of these structures, and the same is true of birds stimulated with antuitrin, while again, regression of the gonads occurs in normal breeding-season birds, if they are treated with adrenalin. The mechanism of this effect is not fully known.

It is known that muscular activity stimulates adrenalin secretion while at the same time reducing the adrenalin content of the gland. Here, the author suggests, is a possible explanation of Rowan's results. This investigator produced in experimental birds an increase in size of gonads by subjecting them by mechanical device to longer hours of *exercise* instead of light, and also found that Starlings in busy London were, by increased wakefulness, brought to a condition of well-developed gonads by February 10, while those in the country a week later, were nearly quiescent. The result of increased exercise is to decrease the available adrenalin in the blood, so that "as it falls below its gonadal antagonistic value the anterior pituitary-gonad mechanism is enabled to function." With diminution of activity the adrenalin again reaches the threshold where its antagonistic value suppresses the gonadotropic effect. (But see the following paper.)

While thus the conflicting views of Bissonnette and Rowan may be brought into harmony, we have yet to explain why in the tropics, where light is uniform and length of day nearly constant, wintering migrants show enlarged gonads before they leave for the north. Again, what are the stimuli for the ripening of the gonads in resident tropical species? Does the reduction of light intensity in a rainy season have an effect? Is there a physiological rhythm in tropical birds that partly replaces the effect of light and exercise in northern species? It seems therefore that much more experimental work must be done with birds of low latitudes before the complete solution of these problems is attained.—G. M. ALLEN.

**Toxic effect of Adrenalin on young Pigeons.**—The experiment described herewith was undertaken to test further J. C. Perry's theory ('The antagonistic action of adrenalin on the reproductive cycle of the English Sparrow, *Passer domesticus* (Linnaeus).', Anat. Record 79: 57-77, 3 pls., 1941) that adrenalin acts as an antagonist to the gonadotropic hormones in birds. Four series of squabs (*Columba livia*) were used in this work and given the following treatments: (1) uninjected controls; (2) birds injected with one and one-half rat-units of pituitary extract per day; (3) birds injected with the same amount of gonadotropic substance and three

and one-half minims of adrenalin 1/1000 dilution (Parke Davis); (4) birds injected with the same amount of gonadotropic substance and 175 mg. of Witte's peptone in one cc. of water (a rat-unit is here defined as the minimum total amount of pituitary extract which, injected twice daily into twenty-one-day old female rats, will produce in four days an ovarian weight increase 100% greater than normal). The gonadotropic substance was injected into the loose skin of the neck in the morning, and the adrenalin or Witte's peptone was injected into the pectoral muscles in the evening. The birds were injected for two days, given one day's rest, injected for four more days and killed at the beginning of the eighth day of the experiment. Both males and females were injected since no way was known to sex the birds while they were still alive.

Male squabs are very sensitive to the gonadotropic hormones and show great enlargement of testes over very short periods of treatment. Females, on the other hand, though they do respond to gonadotropic injections, react much more slowly. It was hoped that by using male birds a short-term test of Perry's premise could be carried out. His method of injecting the sparrows with adrenalin in the pectoral muscles was followed in the pigeons. According to body weight, to give the squabs an equivalent dose of adrenalin, approximately 6.5 minims would be necessary. However, this dose was found to be so lethal that it was reduced to 3.5 minims daily. The results of the experiments are shown below. The average body-weights of both males and females as well as males alone is included to give a more nearly accurate check.

#### EXPERIMENT 1

##### CONTROLS

	<i>Original weight</i>	<i>Final weight</i>	<i>Testes weight</i>
No. 1	375 grams	376 grams	21.6 milligrams
No. 2	299 "	295 "	17.9 "
No. 3	357 "	335 "	66.7 "
No. 4	375 "	350 "	46.7 "
Average	351 "	339 "	38.2 "

Average weight change for males, — 12 grams.

Average weight change for males and females, — 13 grams.

#### EXPERIMENT 2

##### GONADOTROPIC

No. 1	340 grams	324 grams	155.8 milligrams
No. 2	332 "	315 "	330.7 "
No. 3	408 "	390 "	94.5 "
No. 4	274 "	258 "	201.2 "
No. 5	347 "	369 "	213.0 "
No. 6	324 "	387 "	213.2 "
No. 7	219 "	217 "	106.1 "
Average	321 "	323 "	187.8 "

Average weight change for males, + 2 grams.

Average weight change for males and females, — 3 grams.

## EXPERIMENT 3

## GONADOTROPIC PLUS ADRENALIN

	<i>Original weight</i>	<i>Final weight</i>	<i>Testes weight</i>
No. 1	308 grams	283 grams	138.2 milligrams
No. 2	418 "	373 "	107.3 "
No. 3	353 "	362 "	106.6 "
No. 4	363 "	370 "	105.2 "
No. 5	383 "	320 "	181.0 "
No. 6	244 "	197 "	47.1 "
No. 7	242 "	200 "	93.1 "
Average	330 "	301 "	111.2 "

Average weight change for males, — 29 grams.

Average weight change for males and females, — 36 grams.

## EXPERIMENT 4

## GONADOTROPIC PLUS TOXIC SUBSTANCE

No. 1	247 grams	223 grams	114.6 milligrams
No. 2	286 "	285 "	72.7 "
No. 3	444 "	411 "	217.2 "
No. 4	244 "	244 "	57.1 "
No. 5	292 "	293 "	168.0 "
No. 6	337 "	308 "	198.7 "
No. 7	291 "	281 "	70.0 "
Average	306 "	292 "	128.3 "

Average weight change for males, — 14 grams.

Average weight change for males and females, — 19 grams.

Experiments 1, 2, and 3 were run together before Experiment 4. In all, nine birds were killed by the adrenalin injection. The pectoral muscles of all adrenalin-treated birds were extremely discolored and often edematous at the places of injection. These facts, coupled with the great loss of weight in these birds, suggest strongly that the moderate inhibition shown by the adrenalin-gonadotropic-treated birds when compared with the birds treated with gonadotropic hormone alone, might be simply a toxic effect. Accordingly, the fourth series were injected with sub-lethal doses of a toxic substance, Witte's peptone (peptonum seccum), kindly supplied by Dr. E. B. Astwood, with the results shown in the fourth table.

It will be seen that the testes weights of individual birds given the same treatment vary greatly. This is due to the difficulty of obtaining a large series of birds of precisely the same age. The writer therefore feels that each average of testes weights should be taken as an indication rather than as an exact figure. Keeping this in mind, it is apparent that adrenalin was incapable of inhibiting testes growth very successfully, since the testicular weights of the adrenalin-gonadotropic-treated birds are three times those of the normal birds. Moreover, the birds treated with toxic substance and gonadotropic hormone also showed a decrease in weight of testes when compared with birds treated with gonadotropic hormone alone. The toxic-treated birds did not lose as much weight as the adrenalin-treated ones.

nor were their pectoral muscles badly discolored, and only one bird was killed by the treatment. If a larger toxic dose had been used it is probable that the inhibition of testes growth might equal that of the adrenalin-treated birds.

The writer's criticism of Perry's work is twofold:

(1) The effect of injected adrenalin as an antagonist to the gonadotropic hormones is difficult to explain in view of its transient existence in the blood stream. The statement in Starling's 'Principles of Human Physiology' (1930) still holds true: "When adrenalin is injected into the blood stream the effect is only temporary. It is not excreted in the urine but disappears rapidly from the blood. Since it is easily oxidized and is extremely unstable in alkaline solution we may conclude that, after performing its excitatory function, it is destroyed by oxidation in the fluids." In Perry's third set of experiments especially, where adrenalin was injected only every other day it seems remarkable that it was capable not only of inactivating the gonadotropic hormone present in the blood, but also of nullifying the effects of this hormone injected twenty-four hours previously.

(2) It is felt that the injection of  $\frac{1}{2}$ -minim of 1/1000 adrenalin is a pathological rather than a physiological dose. Using the same dose in proportion to body weight the average dose for a man would be seventy-five c.c.! As low as two c.c. in one injection can be fatal to a man. It is well known that, in mammals, toxic substances and inanition will produce a profound reduction of normal gonadal development and alter the effect of injected hormones.

It is probable, in view of the evidence given here, that adrenalin injection inhibits the action of the gonadotropic hormones in pigeons not because it is a specific antagonist to the gonadotropic hormones, but because its toxicity renders the birds incapable of responding as markedly as they would if they were healthy. It is suggested that this condition might also apply in the case of Perry's work with sparrows.

The author wishes to express his thanks to Dr. F. L. Hisaw for supplying the experimental birds and for much kind and helpful advice.—CHARLES P. LYMAN, *Biological Laboratories, Cambridge, Massachusetts*.

**Lehmann on Attwater's Prairie Chicken.**—This bird, *Tympanuchus cupido attwateri*, is a slightly smaller and more buffy race of the Northern Prairie Chicken.<sup>1</sup> It formerly ranged from extreme southwestern Louisiana southwestward along the entire coast of Texas. The map giving its present and probable former distribution, illustrates graphically how it is now restricted mainly to some half dozen isolated parts of its one-time range. The preferred habitat is the better-drained prairies of this region, for it avoids the salt-marsh areas, except to a limited extent in winter.

A careful survey of the bird's present status indicates a total population of less than nine thousand individuals or about one per cent of its probable numbers before the country was developed by white men. Its total range in the course of the last one hundred years has been reduced more than 98 per cent. While in later times protection has apparently somewhat increased its numbers, it has now reached a low point from which real recovery may be extremely difficult. Human factors against the bird include the appropriation of much of the best part of its range for agriculture, uncontrolled prairie fires, overgrazing and hence destruction of cover, the development of oil fields, the cutting of drainage canals and the

<sup>1</sup> Lehmann, Valgene W. 'Attwater's Prairie Chicken, its life history and management.' No. Amer. Fauna, no. 57, 65 pp., 14 pls., 1941; U. S. Fish and Wildlife Service, Washington, D. C. Price \$0.40 (Superintendent of Documents, Washington).

mowing of grassy areas. Of adverse natural factors extremes of weather are of great importance. A wet breeding season, especially in May, when it is at its height, often transforms large areas into shallow lakes, killing both eggs and young; while excessive heat in summer is again a factor to which the birds are sensitive. The encroachment of brush on prairie lands has rendered thousands of acres of once-favorable country now an unsuitable habitat.

There is an excellent account of the life history, courtship, mating, nesting, development of the young, food, flocking and seasonal activities; and finally a chapter on management, with an account of census methods, directions for habitat improvement, and precautions to be used in harvesting the crop. One cannot but feel, however, that the outlook for Attwater's Prairie Chicken is far from bright even if the various recommendations given could all be followed out forthwith, for as the author concludes, "In the absence of ample reservations for the species all other favorable factors together cannot be counted on to save the bird from extinction." However, while its days may be numbered, we may at least be glad that the author has given us a good account of the bird, its habits and its habitat, and has pointed out what may still be done for its present continuance.—G. M. ALLEN.

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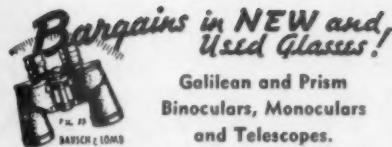
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**OBITUARIES**

JOSEPH HARVEY RILEY, Associate Curator of Birds at the United States National Museum and a Fellow of the American Ornithologists' Union, died on December 17, 1941, following a brief illness. A suitable memorial will be prepared, as is the Union's custom, for the pages of THE AUK.

Just as the last pages of this issue of THE AUK are passing through the press comes word of the death of DR. C. HART MERRIAM at Berkeley, California, on March 19, 1942. Dr. Merriam was a Founder of the A. O. U. and for over 60 years an outstanding figure in American Zoölogy. The President of the Union will appoint a biographer to prepare a memorial for publication in THE AUK.



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